D. Corrective Action

U.S. Environmental Protection Agency
Office of Waste Programs Enforcement
Contract No. 68-W9-0006

TES 9

Technical Enforcement Support at Hazardous Waste Sites Zone III Regions 5,6, and 7

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PRELIMINARY ASSESSMENT/ VISUAL SITE INSPECTION

BASF CORPORATION
CINCINNATI, OHIO
OHD 004 236 816

FINAL REPORT

Prepared for

U.S. ENVIRONMENTAL PROTECTION AGENCY
Office of Waste Programs Enforcement
Washington, DC 20460

Work Assignment No.	:	R05032
EPA Region	:	5
Site No.	:	OHD 004 236 816
Date Prepared	:	February 7, 1992
Contract No.	:	68-W9-0006
PRC No.	:	209-R05032OH01
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CORRECTIVE ACTION STABILIZATION QUESTIONNAIRE

Completed by: Mary Wojciechowski
Date: June 8, 1992

Background Facility Information

Facility Name: BASF Corporation
EPA Identification No.: OHD 004 236 816
Location (City, State): Cincinnati, Ohio
Facility Priority Rank: Low

1. Is this checklist being completed for one solid waste management unit (SWMU), several SWMUs, or the entire facility? Explain.

Entire Facility
3 SWMUs
1 AOC

Status of Corrective Action Activities at the Facility

2. What is the current status of HSWA corrective action activities at the facility?

( ) No corrective action activities initiated (Go to 5)
(X) RCRA Facility Assessment (RFA) or equivalent completed
( ) RCRA Facility Investigation (RFI) underway
( ) RFI completed
( ) Corrective Measures Study (CMS) completed
( ) Corrective Measures Implementation (CMI) begun or completed
( ) Interim Measures begun or completed

3. If corrective action activities have been initiated, are they being carried out under a permit or an enforcement order?

( ) Operating permit
( ) Post-closure permit
( ) Enforcement order
(X) Other (Explain)

Past and future corrective actions are voluntary

4. Have interim measures, if required or completed [see Question 2], been successful in preventing the further spread of contamination at the facility?

( ) Yes
( ) No
(X) Uncertain; still underway
( ) Not required

Additional explanatory notes:

There is no evidence to show that sampling was conducted to verify the success of past corrective actions. There are plans for further remediation at the facility.

Facility Releases and Exposure Concerns

5. To what media have contaminant releases from the facility occurred or been suspected of occurring?

(X) Ground water
( ) Surface water
(X) Air
(X) Soils

6. Are contaminant releases migrating off-site?

( ) Yes; Indicate media, contaminant concentrations, and level of certainty.

Groundwater:
Surface water:
Air:
Soils:

( ) No
(X) Uncertain

7a. Are humans currently being exposed to contaminants released from the facility?

( ) Yes (Go to 8a)
(X) No
( ) Uncertain

Additional explanatory notes:

Ground water is not used for drinking. The nearest surface water is used only for industrial purposes and since the facility is inactive it is not likely that a release to air will occur.

7b. Is there a potential for human exposure to the contaminants released from the facility over the next 5 to 10 years?

( ) Yes
( ) No
(X) Uncertain

Additional explanatory notes:

Ground water is currently not used for drinking. The nearest surface water is used only for industrial purposes and since the facility is inactive it is not likely that a release to air will occur.

8a. Are environmental receptors currently being exposed to contaminants released from the facility?

( ) Yes (Go to 9)
(X) No
( ) Uncertain

Additional explanatory notes:

Ground water is not used for drinking. The nearest surface water is used only for industrial purposes and since the facility is inactive it is not likely that a release to air will occur.

8b. Is there a potential that environmental receptors could be exposed to the contaminants released from the facility over the next 5 to 10 years?

( ) Yes
( ) No
(X) Uncertain

Additional explanatory notes:

Ground water is not used for drinking. The nearest surface water is used only for industrial purposes and since the facility is inactive it is not likely that a release to air will occur.

Anticipated Final Corrective Measures

9. If already identified or planned, would final corrective measures be able to be implemented in time to adequately address any existing or short-term threat to human health and the environment?

   ( ) Yes
   ( ) No
   (X) Uncertain

   Additional explanatory notes:

Further site remediation is planned but it is not known what type of remediation will be done.

10. Could a stabilization initiative at this facility reduce the present or near-term (e.g., less than two years) risks to human health and the environment?

    (X) Yes
    ( ) No
    ( ) Uncertain

    Additional explanatory notes:

Stabilization could prevent existing contamination from spreading.

11. If a stabilization activity were not begun, would the threat to human health and the environment significantly increase before final corrective measures could be implemented?

    ( ) Yes
    (X) No
    ( ) Uncertain

    Additional explanatory notes:

Stabilization could prevent existing contamination from spreading.

Technical Ability to Implement Stabilization Activities

12. In what phase does the contaminant exist under ambient site conditions? Check all that apply.

    ( ) Solid
    (X) Light non-aqueous phase liquids (LNAPLs)
    (X) Dense non-aqueous phase liquids (DNAPLs)
    (X) Dissolved in ground water or surface water
    ( ) Gaseous
    ( ) Other _____

13. Which of the following major chemical groupings are of concern at the facility?

    (X) Volatile organic compounds (VOCs) and/or semi-volatiles
    ( ) Polynuclear aromatics (PAHs)
    ( ) Pesticides
    (X) Polychlorinated biphenyls (PCBs) and/or dioxins
    ( ) Other organics
    ( ) Inorganics and metals
    ( ) Explosives
    ( ) Other _____

14. Are appropriate stabilization technologies available to prevent the further spread of contamination, based on contaminant characteristics and the facility's environmental setting? [See Attachment A for a listing of potential stabilization technologies.]

(X) Yes; Indicate possible course of action.
Removal of contaminated soil and possibly treatment of ground water would be appropriate stabilization technologies.

( ) No; Indicate why stabilization technologies are not appropriate; then go to Question 18.

15. Has the RFI, or another environmental investigation, provided the site characterization and waste release data needed to design and implement a stabilization activity?

(X) Yes
( ) No

If No, can these data be obtained faster than the data needed to implement the final corrective measures?

( ) Yes
( ) No

Timing and Other Procedural Issues Associated with Stabilization

16. Can stabilization activities be implemented more quickly than the final corrective measures?

(X) Yes
( ) No
( ) Uncertain

Additional explanatory notes:

17. Can stabilization activities be incorporated into the final corrective measures at some point in the future?

(X) Yes
( ) No
( ) Uncertain

Additional explanatory notes:

Conclusion

18. Is this facility an appropriate candidate for stabilization activities?

(X) Yes
( ) No, not feasible
( ) No, not required
( ) Further investigation necessary

Explain final decision, using additional sheets if necessary.

Previous site assessments revealed the presence of volatiles or semivolatiles and PCBs in soil and ground water. The sources of this contamination are believed to be a former waste storage area, a former UST farm and fire fighting operations from a 1990 explosion and fire which caused the facility to shut down. Releases to air have occurred in the past but since the facility is no longer operating they are not likely to reoccur.

Some corrective actions have taken place in the past but there is no evidence to show that these actions were successful.

Further corrective action is planned but no further information is available. This corrective action should include removal of contaminated soil and possibly treatment of contaminated ground water.

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LIST OF FIGURES

EXECUTIVE SUMMARY

PRC Environmental Management, Inc. (PRC), performed a preliminary assessment and visual site inspection (PA/VSI) to identify and assess the existence and likelihood of releases from solid waste management units (SWMU) and other areas of concern (AOC) at the BASF Corporation (BASF) facility in Cincinnati, Ohio. This report summarizes the results of the PA/VSI and evaluates the potential for releases of hazardous wastes or hazardous constituents from SWMUs and AOCs identified.

Three companies have operated the facility since 1921:

- Aulton-Weiberg - operated the facility from 1921 to 1926
- Inmont Corporation (Inmont) - operated the facility from 1926 to 1988
- BASF - operated the facility from 1988 to 1990

These companies manufactured varnishes and paints for interior and exterior coatings of food and beverage containers for 69 years, from 1921 to 1990. BASF employed about 90 people, and used about 20 buildings on 9 acres of land. Early manufacturing processes were not significantly different than later operations at the facility. BASF was a hazardous waste storage facility with greater than 90-day storage in containers. Manufacturing operations were halted by an explosion, and fire at the facility on July 19, 1990. BASF is in the process of closing the entire facility because of the 1990 explosion and fire. Cleanup investigations and demolition have been conducted since the fire and explosion occurred at the facility. Waste generated by cleanup operations includes concrete and bricks from building demolition, scrap metal that is decontaminated prior to off-site transport, decontamination fluids, spent solvents and resins drained from old pipelines (D001, D035, F003, and F005), and wastewater.

Emergency response actions following the explosion and fire, resulted in removal of hazardous wastes from the facility. A consultant was hired to perform a site investigation to determine the extent of contamination remaining at the facility. The site investigation was completed in July 1991, and remediation activities are scheduled for the second quarter of 1992. BASF is conducting all investigations and remediation activities voluntarily.

The PA/VSI identified the following three SWMUs and one AOC at the facility:

Solid Waste Management Units

1. Hazardous Waste Drum Storage Pad
2. Satellite Accumulation Areas

3. Emergency Response Drum Storage Area

Area of Concern

1. Underground Storage Tank Areas

Releases have occurred from leaking Underground Storage Tank Areas (AOC 1), leaking drums at the Hazardous Waste Drum Storage Pad (SWMU 1), and firefighting operations during the explosion and fire in 1990. Releases have occurred to groundwater, surface water, air, and on-site soils. Soils contaminated with polychlorinated biphenyls were removed in early 1991. All underground storage tanks and their contents have been removed from these areas.

The Emergency Response Drum Storage Area (SWMU 3) is currently used for less than 90-day storage of hazardous wastes generated by clean-up, salvage, and demolition operations at the facility. This unit is located very close to a public street and has no secondary containment.

The nearest surface water body is Mill Creek, located about 3 miles west of the facility. Mill Creek is used as an industrial and residential storm water discharge stream. No recreational use is made of Mill Creek.

Ground water is not used for drinking water supplies in the area. Drinking water is supplied by surface water intakes on the Ohio River by the City of Cincinnati Waterworks plant in California, Ohio. These surface water intakes for drinking water supplies are located about 10 miles upstream of the Ohio River and Mill Creek confluence. The lower aquifer of the Norwood Trough is used for limited industrial water supplies. However, industrial users are located about 3 miles northeast and upgradient of BASF.

There are no sensitive environments within 2 miles of the facility. Facility access is controlled by an 8-foot-high, chain-link fence and security guards.

PRC recommends EPA oversight and review of remediation plans and activities at the facility. In addition, secondary containment should be added to SWMU 3.

1.0 INTRODUCTION

PRC Environmental Management, Inc. (PRC), received Work Assignment No. R05032 from the U.S. Environmental Protection Agency (EPA) under Contract No. 68-W9-0006 (TES 9) to conduct preliminary assessments (PA) and visual site inspections (VSI) of hazardous waste treatment and storage facilities in Region 5.

As part of the EPA Region 5 Environmental Priorities Initiative, the RCRA and CERCLA programs are working together to identify and address RCRA facilities that have a high priority for corrective action using applicable RCRA and CERCLA authorities. The PA/VSI is the first step in the process of prioritizing facilities for corrective action. Through the PA/VSI process, enough information is obtained to characterize a facility's actual or potential releases to the environment from solid waste management units (SWMU) and areas of concern (AOC).

A SWMU is defined as any discernible unit at a RCRA facility in which solid wastes have been placed and from which hazardous constituents might migrate, regardless of whether the unit was intended to manage solid or hazardous waste.

The SWMU definition includes the following:

- RCRA-regulated units, such as container storage areas, tanks, surface impoundments, waste piles, land treatment units, landfills, incinerators, and underground injection wells
- Closed and abandoned units
- Recycling units, wastewater treatment units, and other units that EPA has generally exempted from standards applicable to hazardous waste management units
- Areas contaminated by routine and systematic releases of wastes or hazardous constituents. Such areas might include a wood preservative drippage area, a loading-unloading area, or an area where solvent used to wash large parts has continually dripped onto soils.

An AOC is defined as any area where a release to the environment of hazardous waste or constituents has occurred or is suspected to have occurred on a nonroutine and nonsystematic basis. This includes any area where such a release in the future is judged to be a strong possibility.

The purpose of the PA is as follows:

- Identify SWMUs and AOCs at the facility.
- Obtain information on the operational history of the facility.
- Obtain information on releases from any units at the facility.
- Identify data gaps and other informational needs to be filled during the VSI.

The PA generally includes review of all relevant documents and files located at state offices and at the EPA Region 5 office in Chicago.

The purpose of the VSI is as follows:

- Identify SWMUs and AOCs not discovered during the PA.
- Identify releases not discovered during the PA.
- Provide a specific description of the environmental setting.
- Provide information on release pathways and the potential for releases to each medium.
- Confirm information obtained during the PA regarding operations, SWMUs, AOCs, and releases.

The VSI includes interviewing appropriate facility staff, inspecting the entire facility to identify all SWMUs and AOCs, photographing all SWMUs, identifying evidence of releases, initially identifying potential sampling locations, and obtaining all information necessary to complete the PA/VSI report.

This report documents the results of a PA/VSI of the BASF Corporation (BASF) facility in Cincinnati, Ohio. The PA was completed on December 6, 1991. PRC gathered and reviewed information from the Cincinnati Department of Health, the Ohio Environmental Protection Agency (OEPA), and EPA Region 5 RCRA files. The VSI was conducted on December 9, 1991. It included interviews with three facility representatives and a walk-through inspection of the facility. Three SWMUs and one AOC were identified at the facility.

The VSI is summarized and 3 inspection photographs are included in Attachment A. Field notes from the VSI are included in Attachment B.

2.0 FACILITY DESCRIPTION

This section describes the facility's location, past and present operations (including waste management practices), waste generating processes, release history, regulatory history, environmental setting, and receptors.

2.1 FACILITY LOCATION

The BASF facility is located at 1720 Dana Avenue. The facility straddles the City of Cincinnati and the City of Norwood corporation line in central Hamilton County, Ohio (latitude 39°07'36" N and longitude 84°28'30" W), as shown in Figure 1. BASF occupies 9 acres in a mixed commercial and residential area.

The BASF facility is bordered on the north by the Norfolk and Western Railroad, C.W. Zumble Company Beverage Carrier and Warehouse, Discovery Press Incorporated, Lexington Avenue, and Superior Metal products; on the east by Montgomery Road, Web Graphics, Taco Casa, and Evanston School; on the south by Dana Avenue, United Dairy Farmers, residential housing (with basements), Alston Brothers' Car Wash, Dana Auto Service, Kleen Products Incorporated, and Roto Press; and on the west by Norfolk and Western Railroad, Cincinnati Bell, and the Xavier University physical plant (see Figure 2).

2.2 FACILITY OPERATIONS

Three companies have operated the facility since 1921:

- Aulton-Weiberg - operated the facility from 1921 to 1926
- Inmont Corporation (Inmont) - operated the facility from 1926 to 1988
- BASF - operated the facility from 1988 to 1990

These companies manufactured varnishes and paints for interior and exterior coatings of food and beverage containers for 69 years, from 1921 to 1990. BASF employed about 90 people and used about 20 buildings. Early manufacturing processes were not significantly different than later operations at the facility. Manufacturing operations were halted by the July 19, 1990 explosion and fire at the facility. Clean-up investigations, and demolition have been conducted since the fire and explosion occurred.

SCALE: 1" = 2,000'

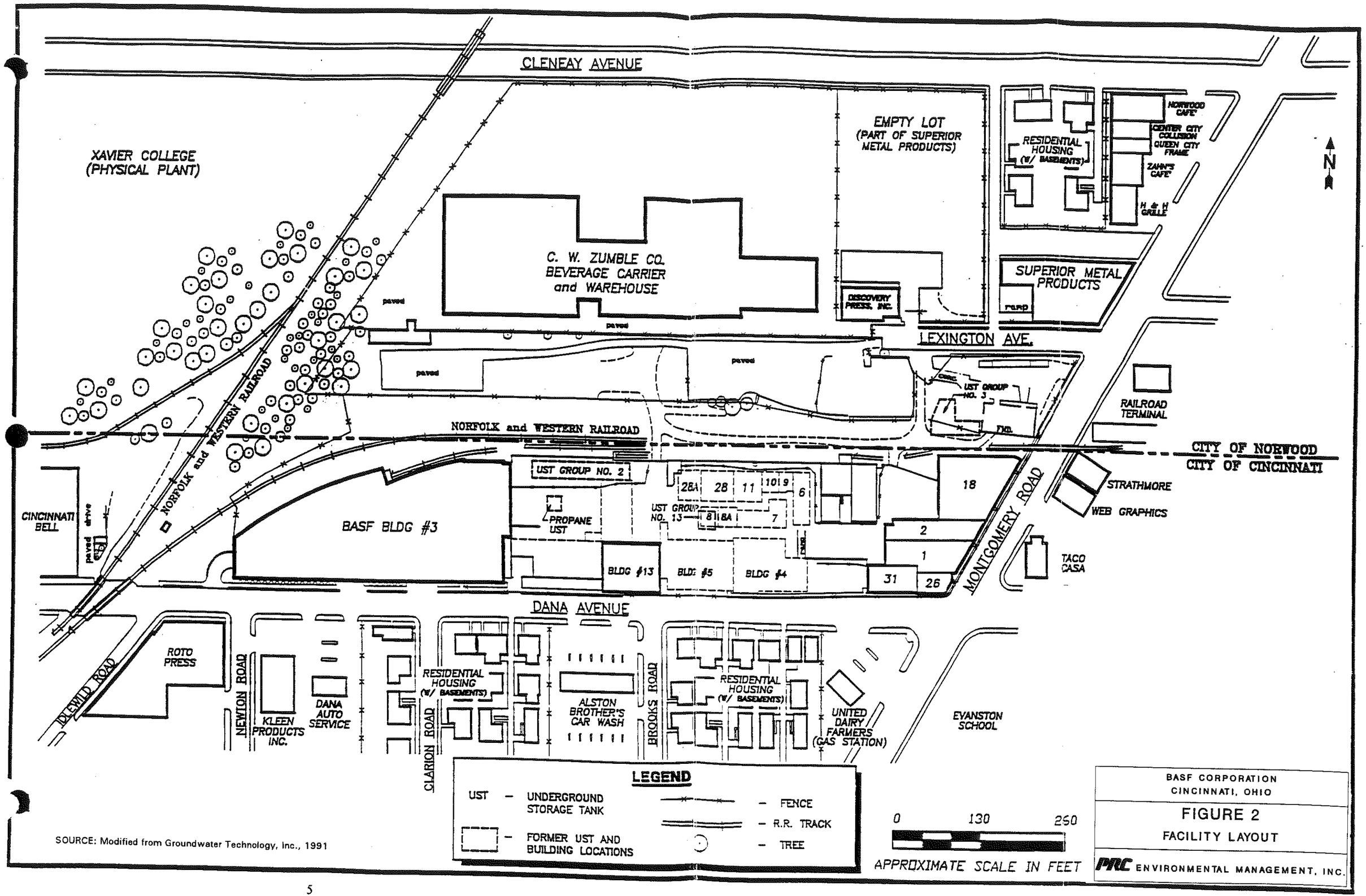
BASF CORPORATION
CINCINNATI, OHIO

FIGURE 1

FACILITY LOCATION

SOURCE: USGS 7 ½ Minute Topographical Quadrangle Map, Cincinnati East, Ohio, 1961, photorevised 1981.

PRC ENVIRONMENTAL MANAGEMENT, INC.



SOURCE: Modified from Groundwater Technology, Inc., 1991

BASF CORPORATION
CINCINNATI, OHIO

FIGURE 2
FACILITY LAYOUT

PRC ENVIRONMENTAL MANAGEMENT, INC.

A resin plant at the facility manufactured the resin component of the coatings in chemical reactors. The resins were then piped to a storage building where drums were filled. These drums were then transported to a shipping and receiving warehouse for shipment to customers.

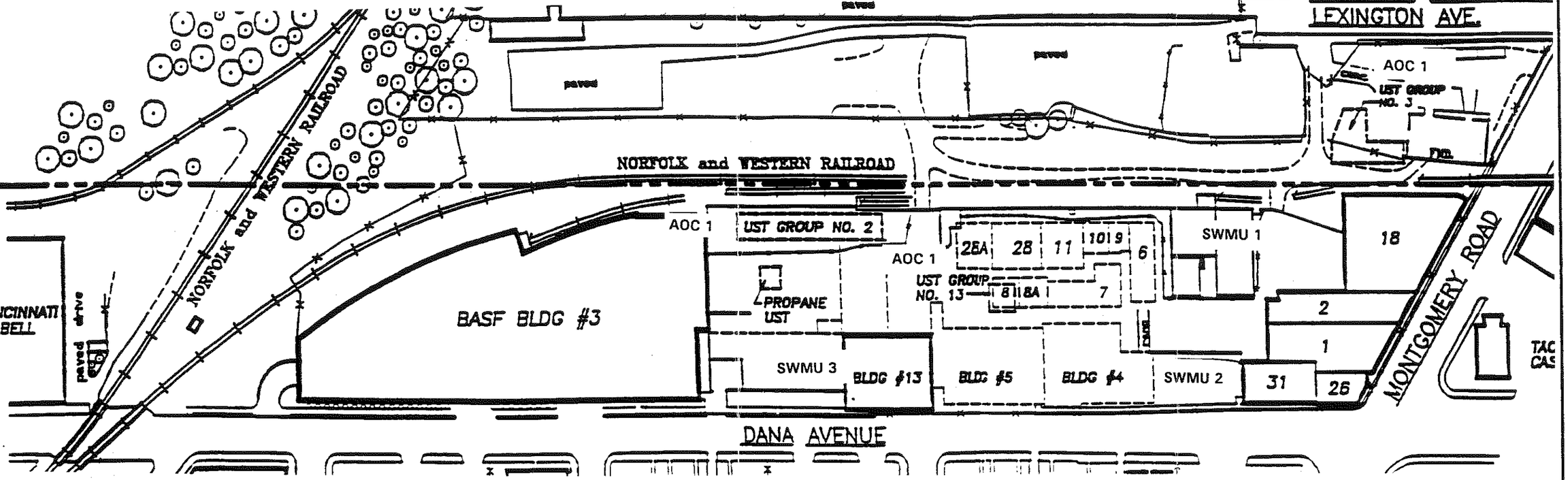
All hazardous wastes were stored at the Hazardous Waste Drum Storage Pad (SWMU 1, see Figure 3 and Table 1). Satellite Accumulation Areas (SWMU 2) were located near the Research and Development and Quality Control Laboratories. An Emergency Response Drum Storage Area (SWMU 3) is used for storage of hazardous wastes generated by cleanup and demolition work currently in progress at the facility.

At 2:18 p.m. on July 19, 1990, Chemical Reactor 6 in the resin plant (Building 28) became overpressured and released a flammable solvent vapor. Reactor 6 was being cleaned with about 3,000 pounds of flammable cleaning solvent blend. During the cleaning operation, Reactor 6 was filled with the solvent blend and mechanically agitated as steam heat was applied to the vessel. Mechanical or human error resulted in failure of the release valve, causing tank pressure to exceed safe operating limits. The emergency rupture disc released the excess pressure, and a solvent vapor cloud was released. The vapor ignited seconds after release, which caused an explosion and fire that damaged most of the facility. Six or seven smaller explosions followed the initial explosion (Cincinnati Fire Division, 1990). The explosion damaged Buildings 7, 8, 11, 17, and 28; Buildings 6, 9, and 28A suffered fire damage. Houses and other buildings 3 miles from the facility were damaged by the explosion. Two BASF employees were killed, and 90 workers and residents were injured from the explosion, fire, and flying glass. Many houses had windows blown out, causing an estimated $50 million in damages to homes in the area (Cincinnati Enquirer, 1991).

2.3 WASTE GENERATING PROCESSES

Waste presently generated at the BASF facility is from cleanup and demolition work done since the July 19, 1990, explosion and fire. Hazardous waste streams generated prior to the explosion were from tank and line cleaning, filtering solid impurities from products, and laboratory operations (see Table 2). PRC was unable to obtain detailed documentation on waste streams generated prior to the explosion.

The July 19, 1990, explosion and fire halted manufacturing operations at the facility. BASF and OEPA developed a plan to deal with waste generated by cleanup and demolition operations at the facility (BASF, 1990d). These waste materials have been classified as follows:



LEGEND

SWMU 1 - HAZARDOUS WASTE DRUM STORAGE PAD
SWMU 2 - SATELLITE ACCUMULATION AREAS
SWMU 3 - EMERGENCY RESPONSE DRUM STORAGE AREA

AOC 1 - UNDERGROUND STORAGE TANK AREAS

SOURCE: Modified from Groundwater Technology, Inc., 1991

NOT TO SCALE

BASF CORPORATION
CINCINNATI, OHIO

FIGURE 3
SWMU AND AOC LOCATIONS

PRC ENVIRONMENTAL MANAGEMENT, INC.

TABLE 1

SOLID WASTE MANAGEMENT UNITS (SWMU)

SWMU Number	SWMU Name	RCRA Hazardous Waste Management Unit*	Status
1	Hazardous Waste Drum Storage Pad	Yes	Inactive
2	Satellite Accumulation Areas	No	Inactive
3	Emergency Response Drum Storage Area	No	Active

Note:

* A RCRA hazardous waste management unit is one that currently requires or formerly required submittal of a RCRA Part A or Part B permit application.

TABLE 2

SOLID WASTES

Waste/EPA Waste Code	Source	Primary Management Unit*
Formaldehyde Waste Solution/U122	Periodic cleanup of underground product storage tanks	Vacuumed directly from tank to transporter tanker truck
Flammable Wastewater/D001, D035, F003, F005	Resin plant filtering and emergency response cleanup operations	1 and 3
Flammable Solid/D001	Resin plant filtering, tank and line cleaning, and emergency response cleanup operations	1 and 3
Flammable Liquid Waste/ D001, F003, F005	Coating manufacture, laboratory waste, and empty drums	1, 2, and 3
Process Wastewater/ nonhazardous	Excess process water from the resin plant	Sanitary sewers

* Note:
Primary management unit refers to a SWMU that currently manages or formerly managed the waste.

- Containerized wastes
- Soil and debris
- Bulk wastewater
- Asbestos
- Miscellaneous wastes

Each of these wastes is grouped into one of the following waste classes on a case-by-case basis:

- Hazardous waste
- Special waste
- Sanitary waste

The wastes are disposed of using the following methods:

- Fuel blending (Systech; Greencastle, Indiana)
- Chemical or physical treatment (Heritage Environmental Services; Indianapolis, Indiana)
- Liquids incineration (Rollins Environmental Services; Deer Park, Texas)
- Solids incineration (Ensco; El Dorado, Arkansas)
- Sanitary waste and demolition waste landfilling (Rumpke Industrial Waste Landfill; Cincinnati, Ohio)
- Scrap metal recycling (American Compressed Steel; Cincinnati, Ohio)

Soil and debris are tested to determine the appropriate disposal method. The facility currently manages D001, D035, F003, and F005 hazardous wastes. Bulk wastewater is tested prior to release to the Metropolitan Sewer District (MSD). When wastewater is not suitable for MSD discharge, it is shipped offsite for fuel blending or incineration. Scrap metal is inspected prior to off-site shipment for recycling; it is decontaminated as necessary with a high-pressure washer. Asbestos is collected and packaged as required under federal regulations; it is disposed of as special waste at the Rumpke Industrial Waste Landfill (BASF, 1990d).

Prior to the explosion, process wastewater was generated in the form of water left over from chemical reactions. This excess process water was decanted, left the drains of Buildings 28

and 28A, and was routed through one of two sumps or catch basins outside the buildings. From this point, the water flowed into another sump or catch basin where the effluent from both buildings could be sampled before it was discharged into the sewer main. In 1988, the flow into the sewer system was measured at about 31,000 gallons per day. It is unknown how much non-process wastewater was discharged from the cooling tower, boiler blow-down, and domestic sewage (MSD, 1989). In early 1990, the facility began drumming wastewater that did not meet MSD discharge requirements. This waste was managed at SWMU 1.

Manufacturing and laboratory operations produced D001, D035, F003, and F005 hazardous wastes prior to the explosion. Equipment cleaning and production filtering to remove solid impurities were the primary operations that generated hazardous waste. The Generator Annual Hazardous Waste Report submitted by BASF states that the facility generated 3,087,218 pounds of hazardous waste in 1989 (BASF, 1989b).

2.4 HISTORY OF DOCUMENTED RELEASES

This section discusses the history of documented releases to ground water, surface water, air, and on-site soils at the BASF facility.

PRC found MSD reports dating back to 1980 concerning odor problems at the BASF facility. In 1980, a dormitory at Xavier University had to be evacuated because of odors released from the facility. In about 1982, several people from a nearby business were sent to a hospital after being overcome by fumes emanating from the sewers. The MSD investigated the complaints and notified OEPA. OEPA responded to the complaint by MSD that hazardous materials were being discharged into the ground surrounding the facility. Two samples were then taken at the facility: a leachate stream was sampled at the rear of the facility, and a sample was taken of material being discharged to the sewer (see Table 3) (OEPA, 1982).

MSD found the facility to be in violation of their Wastewater Discharge Permit MIL-015. BASF exceeded vapor space organic (VSO) concentration limits four different times. In September 1989 the following specific violations were found:

Date	Allowable Limit (VSO concentration in parts per million - ppm)	Concentration Found
6/27/89	450	2,994
8/01/89	450	2,600
8/10/89	450	4,200
8/16/89	450	700

TABLE 3

OEPA SAMPLING RESULTS

Leachate Stream

Parameter	Analytical Results (milligrams per liter - mg/L)
Methyl isobutyl ketone	0.1
Toluene	1.0
2-Butoxyethanol	0.2
Ethyl benzene	0.3
Xylene	2.0
High boiling naphtha	787.1

Material Discharged to Sewer

Parameter	Analytical Results (mg/L)
Toluene	33.4
Ethyl benzene	150.9
Xylene	562.8

MSD ordered BASF to take action to bring the facility into compliance with its wastewater discharge permit (MSD, 1989). In early 1990, the facility began drumming wastewater that did not meet MSD discharge requirements.

In December 1989 and January 1990, Petro Environmental Technologies (PET) was hired by the facility to close Underground Storage Tank Farm 59 and Tank Group 3 respectively. Seven soil borings were completed and seven monitoring wells were installed in these borings. A concrete pad was found beneath the tanks, sampled, and found to contain volatile organic contaminants at concentrations of 50 to 70 parts per billion. The products that leaked from the tanks were listed wastes (U- and P- wastes). The cleanup was conducted in accordance with 40 CFR Parts 280 and 281 (BASF, 1989a).

On February 26, 1990, BASF reported a spill of PX solvent (a mixture of xylene, toluene, methyl ethyl ketone, mineral spirits, and butanol) to the MSD sewer. The spill occurred at about 7:30 a.m. and was reported to MSD at 8:10 a.m. The City of Cincinnati Fire Department was on site at 7:45 a.m. in response to a neighbor's complaint of solvent odor. The spill occurred when cleaning solvent was being transferred to a 5,000-gallon mix tank. The tank agitator splashed material out the tank manway to the process area floor. Spilled material was squeegied and mopped up. Material that could not be mopped was washed to a nearby spill containment pit to be pumped off site for disposal. About 20 to 50 gallons of material escaped to a yard drain and the MSD sewer via the resin sump (BASF, 1990a).

On March 6, 1990, the OEPA notified the facility that a drum on the Hazardous Waste Drum Storage Pad (SWMU 1) was leaking onto the ground (BASF, 1990b). BASF cleaned up the spill; no sampling was performed.

On July 19, 1990, when the BASF facility explosion and fire occurred, fire fighters, OEPA officials, and BASF employees observed a large volume of firefighting water being discharged into the MSD system. In addition, a large volume of water was discharged through an unlined swale located at the north boundary of the manufacturing area along the Norfolk Southern Railroad. The ditch carried water westward to Dana Avenue, where it was discharged to street storm sewers. The manufacturing area is at a higher elevation than the swale, and some seepage of discolored water through the swale walls was observed during the emergency response investigations. Two sumps were installed to prevent off-site migration of this water. Samples were taken in the swale, and contaminated soil and water were removed (BASF, 1990e).

In July and August 1990, Heritage Remediation/Engineering, Incorporated (Heritage), drilled five soil borings on facility property. These borings were converted into wells. The purpose of these wells was to determine whether firefighting operations had impacted the subsurface. Two soil samples each from borings MW-3, MW-4, and MW-5 were selected for the following analyses: volatile and semivolatile organics, polychlorinated biphenyls (PCB), and metals. In addition, ground-water samples were obtained from wells MW-4 and MW-5. Heritage also obtained ground-water samples from six of the seven wells installed by PET (Groundwater Technology, Inc., 1991). No volatile or semivolatile organic compounds were detected in ground water samples from wells MW-4 and MW-5. Acetone was found in boring B-5, and the presence of tetrahydrofuran in boring B-2, B-3, and B-6 was thought to be caused by the polyvinyl chloride (PVC) pipe cement used during well installation (Groundwater Technology, Inc., 1991). These wells were later abandoned.

No volatile or semivolatile target organic compounds were detected in soil samples collected from borings taken during the drilling of wells MW-3, MW-4, and MW-5. These borings were taken in the northern portion of the property.

In December 1990, Groundwater Technology, Inc., was hired to conduct a three-phase investigation of the facility. This investigation is outlined below.

Phase I (work plan submitted on November 6, 1990):

- Plugged and abandoned wells B-1 through B-7 (installed by PET) in Tank Group 3 area because of uncertainties associated with well construction
- Installed and sampled wells MW-7s and MW-7d along Dana Avenue (soil boring samples and ground water samples)
- Installed wells MW-6s and MW-6d to determine the presence of contaminants in upper and lower silt/clay units and ground water near Tank Group 3 (soil boring samples and ground-water samples)
- Sampled pea gravel from Tank Group 2 to determine the presence of contamination in sidewalls in order to meet closure requirements

Phase II (work plan submitted on January 18, 1991):

- Conducted geophysical survey at north end of the property
- Collected soil samples collected at soil borings SB-1, SB-2, and SB-3
- Sampled sidewalls of Tank Group 3 to determine whether a release had occurred in order to meet closure requirements

Phase III (work plan submitted on February 15, 1991):

- Conducted a 16 point soil vapor survey, performed 15 soil borings, and conducted a sampling program to define the areal extent of contamination in the subsurface along the railroad spur (Groundwater Technology, Inc., 1991)

Soil boring analytical results for wells MW-6s, MW-6d, MW-7s, and MW-8s showed only one sample with detectable target organic compounds. A sample taken at the top of the upper aquifer in well MW-6s contained benzoic acid, fluoranthene, pyrene, and chrysene at concentrations of 60 to 90 micrograms per kilogram (µg/kg) (Groundwater Technology, Inc., 1991).

Analytical results for ground water sampled in well MW-7s showed 680 micrograms per liter (µg/L) of tetrachloroethene, 20 µg/L of 1,2-dichloroethene, and 9 µg/L of trichloroethene (Groundwater Technology, Inc., 1991).

Groundwater Technology, Inc., conducted an assessment of soils along the railroad spur. Laboratory results from this investigation showed toluene, ethyl benzene, xylenes, and naphthalene concentrations ranging up to 4,300 parts per billion (ppb) in boring RR-8 at a depth of 1 to 5 feet below ground surface (Groundwater Technology, Inc., 1991).

2.5 REGULATORY HISTORY

Inmont submitted a notification of hazardous waste activity to EPA on August 12, 1980, as a generator, and treatment, storage, and disposal (TSD) facility (Inmont, 1980a). The facility submitted a Part A permit application on November 12, 1980. This application listed the following process codes and capacities: S02, 600 gallons; T03, 20 gallons per hour; and S01, 37,500 gallons. However, the facility claimed that it did not use tanks to store (S02) or treat (T03) hazardous wastes. The application listed the following EPA hazardous waste codes: D001, D002, D003, F003, F005, K054, K078, K079, K080, K082, K086, D007, D008, U002, U008, U031, U052, U057, U113, U122, U159, U161, U162, U188, U190, U220, and U239 (Inmont, 1980b). The facility also claimed that it did not store (S01) hazardous waste for greater than 90 days in the container storage area and sought generator status (Inmont, 1983).

In April 1982, OEPA responded to concerns expressed by MSD that the facility was discharging hazardous materials to the ground and sewers surrounding the facility. OEPA took samples from a leachate stream and from material being discharged to the sewer for chemical

analysis. OEPA, the Cincinnati Fire Department, and Inmont officials held a meeting, and OEPA informed the facility that it was violating state and federal regulations by discharging flammable materials to the ground and sewer system. The facility was ordered to dam the leachate stream and to dispose of the material by incineration. In addition, the facility was ordered to stop discharging hazardous materials to the sewer system. MSD informed the facility that a fine would be levied because Inmont was in violation of its permit. The facility assured OEPA that it would determine the source of the material and rectify the problem immediately (OEPA, 1982). Table 4 is a summary of the facility's MSD compliance history from 1988 to 1990.

RCRA compliance inspections (CEI) were conducted from 1980 to 1990. The facility was inspected by OEPA as a generator of hazardous waste until 1990. One RCRA CEI was conducted by representatives of OEPA on August 15, 1985. This inspection found that the facility was not conducting regular inspections of the Hazardous Waste Drum Storage Pad (SWMU 1) in violation of 40 CFR 265.174 (OEPA, 1985).

In 1988, BASF informed OEPA of its name change from Inmont Corporation to BASF Corporation Coatings & Inks Division (BASF, 1988). A new notification of hazardous waste activity was not filed.

In September 1989, MSD found the facility to be in violation of Wastewater Discharge Permit MIL-015 for exceeding vapor space organic (VSO) concentration limits (see Section 2.4). BASF was ordered to take action to bring the facility into compliance with its wastewater discharge permit or face fines or penalties (MSD, 1989). BASF also exceeded the discharge permit limits for VSO on February 26, 1990, and April 3, 1990.

BASF is in the process of closing the entire facility because of the 1990 explosion and fire. In 1989, the facility underwent closure of Tank Farms 59 and 3. In November 1990, Tank Farm 2 was closed. Tank Farm 13 was closed in February 1991. Soils were removed from an area behind Building 28 in February 1991 because of PCB contamination (Groundwater Technology, Inc., 1991). PCBs were used as a heat transfer fluid for the chemical reactors.

On March 6, 1990, OEPA notified the facility of violations discovered during a CEI of the facility. The following violations were noted:

- Several drums of hazardous waste located on the Hazardous Waste Drum Storage Pad (SWMU 1) that were open to the environment.
- A drum on the Hazardous Waste Drum Storage Pad was found leaking onto the ground.

TABLE 4

SUMMARY OF MSD COMPLIANCE HISTORY, 1988 TO 1990

Date	Action
01/06/88	BASF submits monthly monitoring report - no violations
01/28/88	BASF submits monthly monitoring report - one violation
02/12/88	BASF requests organic chemicals, plastics and synthetic fibers (OCPSF) category determination from OEPA
02/28/88	BASF submits monthly monitoring report - one violation
03/01/88	MSD conducts annual investigation
03/01/88	MSD renews Wastewater Discharge Permit MIL-015
03/28/88	BASF submits monthly monitoring report - no violations
04/05/88	OEPA issues OCPSF category determination
04/25/88	BASF reports spill of 500 pounds of phenolic resin to sewer
04/29/88	BASF submits written spill report
05/26/88	BASF submits monthly monitoring report - one violation
06/30/88	BASF submits monthly monitoring report - no violations
07/29/88	BASF submits monthly monitoring report - no violations
08/29/88	BASF submits monthly monitoring report - no violations
09/28/88	BASF submits monthly monitoring report - no violations
10/31/88	BASF submits monthly monitoring report - no violations
11/30/88	BASF submits monthly monitoring report - no violations
12/31/88	BASF submits monthly monitoring report - two violations

January to December 1988: 19 MSD samples, 16 BASF samples, nine VSO concentration violations

01/30/89	BASF submits monthly monitoring report - no violations
02/09/89	MSD conducts annual investigation
02/24/89	BASF submits monthly monitoring report - one violation
03/01/89	MSD renews Wastewater Discharge Permit MIL-015 with OCPSF compliance schedule
04/04/89	BASF submits monthly monitoring report - no violations
04/06/89	BASF reports spill of 4 gallons of toluene
04/10/89	BASF submits written spill report
05/02/89	BASF submits monthly monitoring report - one violation
06/09/89	MSD issues verbal warning for VSO concentrations
06/22/89	BASF submits monthly monitoring report - no violations
06/30/89	MSD issues verbal warning for VSO concentrations
07/04/89	MSD issues notice of violation for VSO concentrations
07/18/89	BASF submits monthly monitoring report - two violations
08/08/89	BASF submits monthly monitoring report - no violations
08/11/89	MSD conducts additional investigation for OCPSF
08/31/89	MSD issues verbal warning for VSO concentrations
09/05/89	BASF submits monthly monitoring report - no violations
09/26/89	MSD issues notice of violation for VSO concentrations
10/06/89	BASF submits monthly monitoring report - no violations

TABLE 4 (Continued)

SUMMARY OF MSD COMPLIANCE HISTORY, 1988 TO 1990

Date	Action
10/31/89	BASF submits written spill report on release of heat transfer fluid during fire
11/08/89	MSD includes BASF on published list of significant violators
11/14/89	BASF submits OCPSF compliance report
12/11/89	BASF submits monthly monitoring report - no violations
January to December 1989:	20 MSD samples, 18 BASF samples, 14 VSO concentration violations
01/18/90	BASF submits monthly monitoring report - one violation
02/01/90	BASF reports spill in progress - 25 gallons of PX solvent enters sewer
02/08/90	BASF submits written spill report
02/26/90	BASF reports spill of 20 gallons of PX solvent to sewer
03/01/90	MSD renews Wastewater Discharge Permit MIL-015 with OCPSF compliance schedule
03/01/90	BASF submits written spill report
03/07/90	MSD issues notice of violation for VSO concentrations
03/07/90	BASF requests permission to discharge storm water from underground storage tank removal site; MSD grants request
03/22/90	MSD conducts annual investigation and reviews spill prevention and control measures
04/09/90	BASF submits monthly monitoring report
05/14/90	MSD issues notice of violation for VSO concentrations
January to May 1990:	nine MSD samples, three BASF samples, two VSO concentration violations

- Numerous containers had accumulation dates indicating waste storage for more than 90 days. One drum on the Hazardous Waste Drum Storage Pad was dated October 29, 1989.
- Several drums on the Hazardous Waste Drum Storage Pad were not properly marked with the start date of accumulation.
- BASF did not notify OEPA of the spill that occurred at their facility February 26, 1990 at 7:30 a.m.

BASF sent OEPA a letter responding to the violations and agreeing to correct the problems (BASF, 1990b).

On May 23, 1990, OEPA sent the facility a letter requesting a decision as to whether BASF would continue to use SWMU 1 after it discontinued operating the resin plant in November 1990 (OEPA, 1990a). The facility responded on June 6, 1990, that it was interested in closing the Hazardous Waste Drum Storage Pad, and that closing the resin plant would significantly reduce the volume of waste generated (BASF, 1990c).

On July 19, 1990, Chemical Reactor 6 in the resin plant exploded, and a fire destroyed much of the facility.

On August 21, 1990, the OEPA received a request from BASF for an extension of the 90-day accumulation period for hazardous wastes at the facility. The request was made to allow safe removal of hazardous wastes affected by the explosion and fire at the facility on July 19, 1990. OEPA granted the request and recommended a 30-day extension with an expiration date of November 16, 1990 (OEPA, 1990b).

2.6 ENVIRONMENTAL SETTING

This section describes the climate, flood plain and surface water, geology and soils, and ground water in the vicinity of the BASF facility.

2.6.1 Climate

The climate in Hamilton County is characterized by cold winters and hot summers. The yearly average temperature is 54°F. The lowest average temperature is 21.7°F in January, and the highest average temperature is 86.8°F in July. Precipitation for southwestern Ohio is well distributed throughout the year. The average yearly precipitation for Hamilton County is 40.07 inches. The annual precipitation peak occurs in March at 4.18 inches, and only 2.38 inches of

precipitation falls in October (USDA, 1982). The 1-year, 24-hour rainfall average is 2.6 inches, and the average yearly net precipitation is 6.0 inches (USDC, 1963). The prevailing wind is from the south-southwest, and the highest average wind speed is 11 miles per hour in winter (USDA, 1982).

2.6.2 Flood Plain and Surface Water

The BASF facility is not located in any known flood plain. Surface water drains from east to west at the facility to an unnamed, intermittent stream. The stream runs northwest for about 1 mile to another intermittent stream that runs west about 3 miles into Mill Creek. Mill Creek flows south for about 4 miles to the Ohio River.

2.6.3 Geology and Soils

BASF is situated near a topographic landform known as the Norwood Trough. The Norwood Trough is a preglacial valley formed by the pre-Illinoian age Ohio River. The pre-Illinoian age Ohio River joined the valley of the north-flowing pre-Illinoian age Licking River (now occupied by Mill Creek).

The Norwood Trough is now a wide, abandoned river valley trending northward from the mouth of the Little Miami River east of Cincinnati via Mariemont, Oakley, and Norwood to Saint Bernard. Overlying the Ordovician age bedrock are thick deposits of glacial outwash sands and gravel that form an aquifer in the trough. The glacial deposits in the Norwood Trough consist of a varied mixture of sand, gravel, and clay. The upper deposits, from 100 to 130 feet thick, consist largely of beds of clay that prevent local recharge of the aquifer. Beds of sand and gravel exist 130 to 240 feet below the surface and become coarser with depth (ODNR, 1946).

The site-specific geology was compiled by Groundwater Technology, Inc., during a three-phase investigation of contamination at the facility (see Section 2.4). Shallow site geology consists of unconsolidated glacial till overlying fluvial sands of Pleistocene age. The general site geology profile is as follows (top to bottom):

- 20-foot layer of brown and gray clayey silt with a trace of fine to medium sand and gravel (till)
- 18-foot layer of gray clayey silt, with some fine to medium sand and gravel; a few thin lenses of brown, fine to medium sand
- 3 feet of interbedded and laminated, brown, fine-grained sand and gray to brown silt

- 20 feet of brown and tan, fine to coarse sand with traces of silt and gravel; gravel concentrated near the top of this unit with occasional lenses in the middle of the unit
- 5 feet of laminated brown and gray silt and clay
- Unit of unknown thickness consisting of laminated, gray silt and clay (BASF, 1990e)

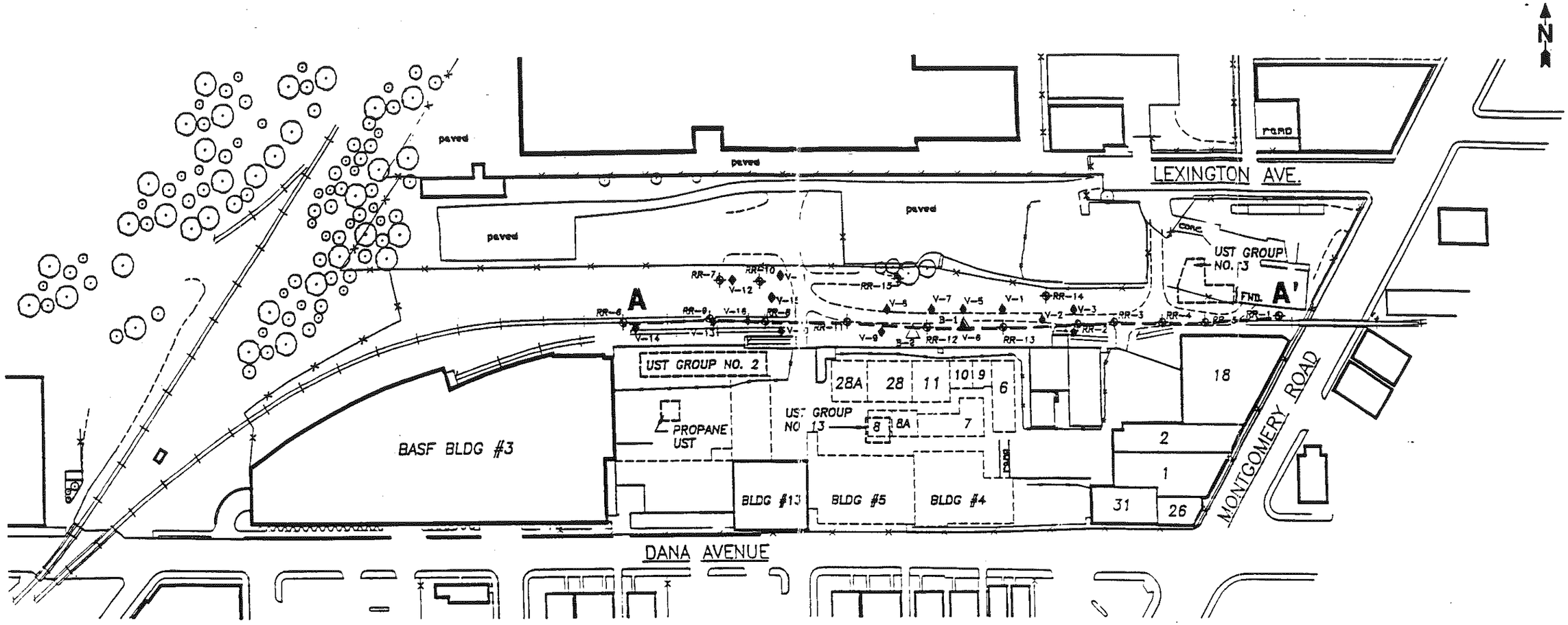
Shale bedrock was encountered at a depth of 33 feet below ground surface at the southern end of the facility along Dana Avenue. This shale formation was also encountered in wells drilled over 80 feet deep at the northeastern end of the facility (Groundwater Technology, Inc., 1991). Figure 4 shows the location of crosssection A-A,' and Figure 5 displays a crosssection of the geology along the facility's northern boundary.

2.6.4 Ground Water

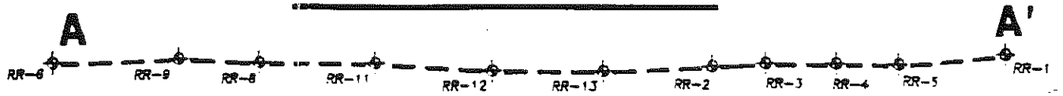
The BASF facility is located on the south side of the buried valley known as the Norwood Trough. The Norwood Trough is filled with glacial deposits 200 to 400 feet thick. Some valley fill contains thick local deposits of sand and gravel that may yield 25 to 100 gallons of water per minute (ODNR, 1986).

PET monitoring wells 1 through 7 indicated that there are two water bearing zones in the northeastern part of the facility. The perched water table is present in the uppermost silt at about 20 feet below grade. In the northeastern portion of the facility, perched water is found within the silt-clay unit, and the sand unit is dry to its base at 80 feet below ground surface. The lower aquifer is present at the base of a sand unit 75 to 80 feet below the surface. Along the southern boundary of the facility, the upper silt-clay unit is about 33 feet thick and overlies bedrock.

Permeability analysis of the silt material in the upper aquifer showed results of 7×10^{-7} to 6×10^{-9} centimeters per second. The degree of interconnection between the upper and lower aquifers is uncertain. Ground-water flow directions were not determined within the upper silt-clay unit in any of the investigations. However, ground-water flow direction is to the northwest, following regional preglacial drainage channels. (Groundwater Technology, 1991).



SECTION CUT A–A' PATH



LEGEND

- SOIL BORINGS
- SOIL VAPOR SURVEY POINTS
- GRAB SAMPLE LOCATION
- UST – UNDERGROUND STORAGE TANK
- FORMER UST AND BUILDING LOCATIONS
- TREE
- TREE
- TREE
- FENCE
- R.R. TRACK
- HEDGE LINE

0 120 240

SCALE IN FEET

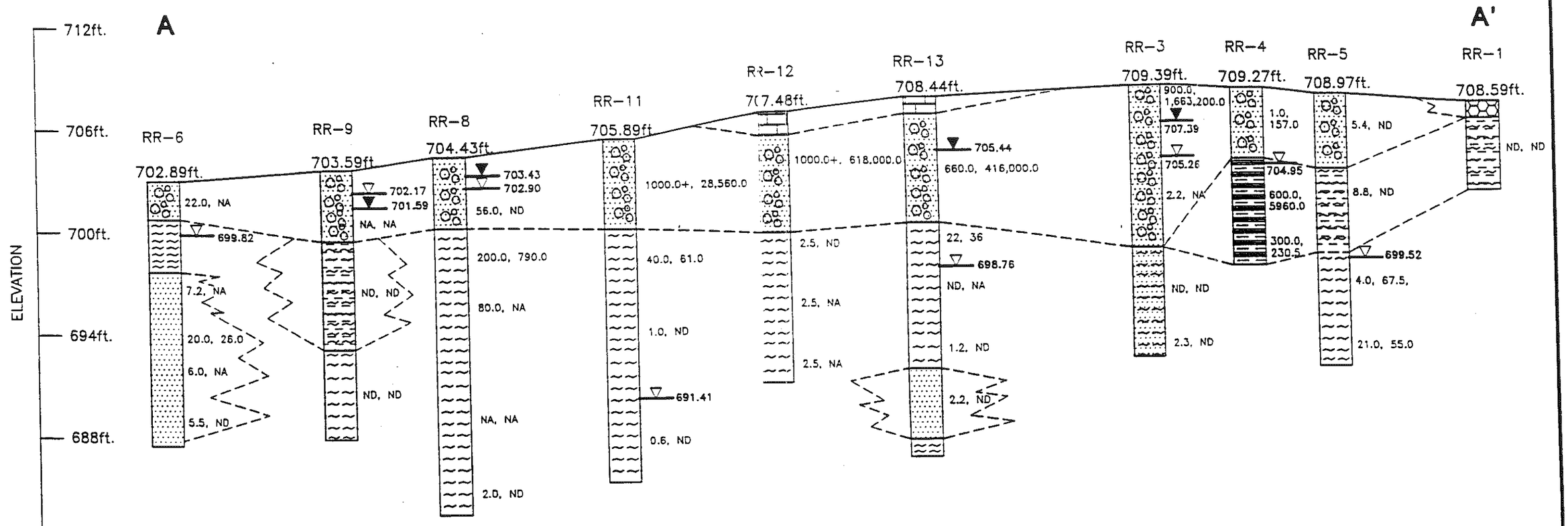
SOURCE: Modified from Groundwater Technology, Inc., 1991

BASF CORPORATION
CINCINNATI, OHIO

FIGURE 4

CROSS-SECTION A-A'

PRC ENVIRONMENTAL MANAGEMENT, INC.



SOIL DESCRIPTIONS

- CLAY
- SAND AND GRAVEL
- CRUSHED LIMESTONE
- SANDY SILT
- RAILROAD BALLAST
- SILT
- SAND
- SILTY CLAY

LEGEND

- ▼ – INITIAL WATER LEVEL
- ▽ – STATIC 24hr. WATER LEVEL (ft.)
- 1.0, 33.0 – HEADSPACE (PPM), FIELD GAS CHROMATOGRAPH (PPB) (TOTAL BTEX)
- ND – NOT DETECTED
- NA – NOT ANALYZED

VERTICAL EXAGERATION 10X

vertical scale in feet
0 6 12
0 60 120
horizontal scale in feet

BASF CORPORATION
CINCINNATI, OHIO

FIGURE 5
RAILROAD SOIL
BORING/FIELD ANALYSIS

PRC ENVIRONMENTAL MANAGEMENT, INC.

SOURCE: Modified from Groundwater Technology, Inc., 1991

2.7 RECEPTORS

The BASF facility occupies 9 acres in a mixed commercial and residential area of Cincinnati and Norwood, Ohio. An estimated 25,000 people live within a 3-mile radius of the facility (Cincinnati Enquirer, 1991).

The BASF facility is bordered on the north by the Norfolk and Western Railroad, C.W. Zumble Company Beverage Carrier and Warehouse, Discovery Press Incorporated, Lexington Avenue, and Superior Metal products; on the east by Montgomery Road, Web Graphics, Taco Casa, and Evanston School; on the south by Dana Avenue, United Dairy Farmers, residential housing (with basements), Alston Brothers' Car Wash, Dana Auto Service, Kleen Products Incorporated, and Roto Press; and on the west by Norfolk and Western Railroad, Cincinnati Bell, and the Xavier University physical plant. Facility access is controlled by an 8-foot-high, chain-link fence and security guards.

The nearest surface water body is Mill Creek, about 3 miles west of the facility. Mill Creek is used as an industrial and residential storm water discharge stream. No recreational use is made of Mill Creek.

Surface water intakes for drinking water supplies are located about 10 miles upstream of the Ohio River and Mill Creek confluence. The nearest downstream drinking water intakes are greater than 15 miles downstream of the Ohio River and Mill Creek confluence. The lower aquifer of the Norwood Trough is used for limited industrial water supplies. However, the industrial users are located about 3 miles northeast and upgradient of BASF. Ground water is not used for any drinking water supplies in the area.

There are no sensitive environments within 2 miles of the facility.

3.0 SOLID WASTE MANAGEMENT UNITS

This section describes the three SWMUs identified during the PA/VSI. The following information is presented for each SWMU: description of the unit, dates of operation, wastes managed, release controls, history of release, and PRC observations. Figure 3 shows the SWMU locations.

SWMU 1 **Hazardous Waste Drum Storage Pad**

Unit Description: The Hazardous Waste Drum Storage Pad was located outdoors in the north-central part of the facility. The unit stored containerized hazardous wastes generated at various locations throughout the facility.

The unit measured 20 feet by 40 feet, had a 6-inch-high berm, and was made of concrete. The pad was not protected from the weather. The concrete berm was destroyed by demolition and cleanup activities after the fire and explosion at the facility in July 1990 (see Photograph No. 1).

Date of Startup: This unit began operations in 1980.

Date of Closure: The unit has been inactive since about November 1990, when much of the hazardous waste at the facility was removed during emergency response actions.

Wastes Managed: This unit managed all containerized hazardous wastes at the facility. Flammable wastewater (D001, D035, F003, and F005), flammable solids (D001), and flammable liquid waste (D001, F003, and F005) were stored in drums at this unit.

Release Controls: The unit was a concrete pad surrounded by a 6-inch-high berm. There was a drain valve at the southeast corner of the pad. The valve was designed to discharge storm water to a sewer near the pad.

History of Release: On March 6, 1990, OEPA notified the facility of violations discovered during a CEI. The following violations were noted:

- Several drums of hazardous waste located on the Hazardous Waste Drum Storage Pad were open to the environment.
- A drum on the Hazardous Waste Drum Storage Pad was found leaking onto the ground.

Observations: The concrete berm has been removed from the pad, and large cracks are visible running down the center of the pad. Waste is no longer stored in this unit.

SWMU 2 **Satellite Accumulation Areas**

Unit Description: The facility had about five Satellite Accumulation Areas prior to the explosion. Three areas were documented in a BASF report to the Cincinnati Fire Division. Buildings 10, 28, and 31 were listed as having Satellite Accumulation Areas on their first floors. Waste stored in Satellite Accumulation Areas was removed by emergency response workers after the explosion and fire. PRC did not observe the locations of these areas because of the unsafe condition of the buildings. In addition, some buildings that contained Satellite Accumulation Areas have been torn down and removed.

Date of Startup: These areas began operations in 1980.

Date of Closure: These areas have been inactive since about November 1990, when much of the hazardous waste was removed during emergency response actions at the facility.

Wastes Managed: These areas were located indoors. They managed hazardous wastes from the Research and Development and Quality Control Laboratories at the facility. Flammable wastewater (D001, D035, F003, and F005), flammable solids (D001), and flammable liquid waste (D001, F003, and F005) were stored in drums near the points of generation.

Release Controls: Hazardous wastes were stored in these areas until drums were filled. Full drums were moved to SWMU 1 for less-than 90-day

storage. These areas were all located indoors. These areas are no longer active.

History of Release: No releases from these areas have been documented.

Observations: These areas were not inspected because of the unsafe condition of the buildings at the facility.

SWMU 3 **Emergency Response Drum Storage Area**

Unit Description: The Emergency Response Drum Storage Area is outdoors at the location of what used to be Building 13. The drums contain residual solvents and resins drained from pipelines and equipment being salvaged or recycled during cleanup and demolition work at the facility (see Photograph No. 2). The unit dimensions are about 8 feet by 20 feet.

Date of Startup: This unit began operation in December 1991.

Date of Closure: The unit is active.

Wastes Managed: Drums of D001 resins and solvents were being managed in this unit during the VSI.

Release Controls: The unit is located outdoors on a concrete pad. There are no berms or secondary containment features.

History of Release: No releases from this unit have been documented.

Observations: During the VSI, 11 drums of D001 resins and solvents were stored on three wood pallets. Some of the drums were straddling a floor scale built into the concrete pad (see Photograph No. 2). No secondary release controls were present.

4.0 AREAS OF CONCERN

PRC identified one AOC during the PA/VSI. This AOC is discussed below; its locations are shown in Figure 3.

AOC 1 Underground Storage Tank Areas

Three Underground Storage Tank Areas were used for storage of raw materials, fuel oil, and intermediate resin products. Tank Group 3 stored toluene, xylene, methyl ethyl ketone (MEK), mineral spirits, butanol, and PX blended solvents. This tank group consisted of five 10,000-gallon tanks and three 15,000-gallon tanks. Tank Group 2 was located at the northeast corner of Building 3 and contained 16 12,000-gallon tanks. Tank Group 13 consisted of two 12,000-gallon tanks that stored intermediate resins and ortho-creosol feedstock.

Tank Group 3 was removed in December 1989 and January 1990. Ground-water samples were taken in April 1990 from monitoring wells near the tank area. Analytical results showed significant total organics contamination. Acetone and tetrahydrofurans were found in two sampling rounds.

Tank Group 2 removal activities revealed toluene, ethyl benzene, and xylenes in concentrations up to 3,700,000 µg/kg. The highest concentrations were near the east wall of the tank pit. Fibrous resin-like deposits were found in this area.

Tank Group 13 removal activity soil sampling revealed toluene (24 to 580 µg/kg), ethyl benzene (15 to 1,200 µg/kg), and xylenes (48 to 3,900 µg/kg) (Groundwater Technology, Inc., 1991).

PRC was unable to obtain a complete report of the analytical results of the site investigation by Groundwater Technology, Inc. Remedial action is scheduled for the second quarter of 1992.

5.0 CONCLUSIONS AND RECOMMENDATIONS

The PA/VSI identified three SWMUs and one AOC at the BASF facility. Background information on the facility's location, operations, waste generating processes, release history, regulatory history, environmental setting, and receptors is presented in Section 2.0. SWMU-specific information, such as the unit's description, dates of operation, wastes managed, release controls, release history, and observed condition, is discussed in Section 3.0. AOCs are discussed in Section 4.0. Following are PRC's conclusions and recommendations for each SWMU and AOC. Table 5 identifies the SWMUs and AOC at the BASF facility and suggested further actions.

SWMU 1 **Hazardous Waste Drum Storage Pad**

Conclusions: Releases to facility soils from this unit have been documented by OEPA representatives.

The past potential for release to ground water was moderate. The upper 20-foot layer of clayey silt at the facility could have retarded migration of hazardous constituents to the ground water, about 20 feet below ground surface. The past potential for release to the nearest surface water, about 3 miles west of the facility, was low. The past potential for release to air was high. An OEPA inspection found an open drum of flammable (D001) waste on the pad.

The current potential for release from this unit to all environmental media is low. The unit has been inactive since about November 1990.

Recommendations: Site-wide remediation is planned for the second quarter of 1992. PRC recommends EPA review and oversight of remediation plans and activities.

SWMU 2 **Satellite Accumulation Areas**

Conclusions: There have been no documented releases from this unit. All Satellite Accumulation Areas were located indoors on concrete floors. All areas were closed following the 1990 explosion and fire.

The potential for release to ground water, surface water, air, and on-site soils is low.

TABLE 5

SWMU AND AOC SUMMARY

SWMU	Dates of Operation	Evidence of Release	Suggested Further Action
1. Hazardous Waste Drum Storage Pad	1980 to 1990	OEPA inspection in February 1990 found evidence of release to site soils	EPA review and oversight of remediation plans, and activities are recommended.
2. Satellite Accumulation Areas	1980 to 1990	None	No further action is recommended.
3. Emergency Response Drum Storage Area	1991 to present	None	Secondary containment should be added to the unit.

AOC	Dates of Operation	Evidence of Release	Suggested Further Action
1. Underground Storage Tank Areas	1941 to 1991	Releases detected during closure and site investigations	EPA review and oversight of remediation plans and activities are recommended.

Recommendations: No further action is required for these units.

SWMU 3 **Emergency Response Drum Storage Area**

Conclusions: This unit handles hazardous wastes in drums, and no secondary containment features exist. Some drums were stored above a floor scale in this unit during the VSI. Any spills could migrate towards the loading dock area about 5 feet from the drums. The loading dock area slopes toward Dana Avenue.

The potential for release to ground water, surface water, air, and on-site soils is low to moderate. The proximity of the unit to Dana Avenue, and lack of secondary containment are the primary reasons for this potential.

Recommendations: Secondary containment should be added to the unit.

AOC 1 **Underground Storage Tank Areas**

Conclusions: The Underground Storage Tank Areas are the sources of most of the contamination at the facility. Sample analytical results show high concentrations of solvents. Vertical contamination of soils appears to be more significant than horizontal contamination.

Due to the on-site soil contamination, the potential for release to ground water is high. However, the potential for release to the nearest surface water, about 3 miles west of the facility is low. Also, because the contamination is below ground and a clayey silt comprises the top soil, the potential for release to air is low.

Recommendations: EPA oversight of activities at the facility is recommended. Remediation plans and activities should be closely monitored.

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ATTACHMENT A

VISUAL SITE INSPECTION SUMMARY AND PHOTOGRAPHS

VISUAL SITE INSPECTION SUMMARY

BASF CORPORATION
Cincinnati, Ohio
OHD 004 236 816

Date:	December 9, 1991
Facility Representatives:	Valerie Thomas, former BASF Corporation (BASF) Environmental Compliance Coordinator Angee Ferneau, BASF Environmental Compliance Coordinator John Leshing, BASF Manager
Inspection Team:	Gabriel J. Rood, PRC Environmental Management, Inc. (PRC) Pete Zelinskas, PRC
Photographer:	Pete Zelinskas
Weather Conditions:	Overcast, light drizzle, about 55°F
Summary of Activities:	The visual site inspection (VSI) began at 10:00 a.m. EST. Gabriel Rood began the inspection with a discussion of the purpose of the VSI. Valerie Thomas, Angee Ferneau, and John Leshing discussed the facility history and operations. The tour of the facility started at about 11:05 a.m. The facility is currently being demolished, and salvage crews are removing equipment and scrap metal from remaining buildings. PRC toured the facility and photographed solid waste management units that could be safely inspected and the area of concern. The facility tour concluded at about 11:45 a.m., and a brief exit interview was conducted.

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Ohio Department of Natural Resources (ODNR), 1946. Ground Water Conditions in Butler and Hamilton Counties, Ohio Division of Water, Bulletin 8, May.

ODNR, 1986. Ground Water Resources Map of Hamilton County.

Ohio Environmental Protection Agency (OEPA), 1982. Interoffice Communication from Chuck Wilhelm, Chief of Hazardous Materials, to Dave Duell, Southwest District Office, April 12.

OEPA, 1985. Letter from Richard Robertson to Jerry Visciani, BASF, August 16.

OEPA, 1990a. Letter from Pat Willoughby to Valerie Thomas, BASF Environmental Coordinator, May 23.

OEPA, 1990b. Letter from Richard L. Shank, Director, to L.C. Fisher, BASF, September 26.

U.S. Department of Agriculture (USDA), 1982. Soil Survey of Hamilton County.

Photograph No. 1 Location: SWMU 1
Orientation: Northwest Date: 12/09/91
Description: Remnants of the concrete pad; berm has been removed

Photograph No. 2 Location: SWMU 3
Orientation: South Date: 12/09/91
Description: Eleven, 55-gallon drums of D001 waste stored on wooden pallets; about six drums resting over a scale

Photograph No. 3 Location: AOC 1
Orientation: West Date: 12/09/91
Description: Tank Farm 3: pit filled with pea gravel; tanks have been removed

ATTACHMENT B

VISUAL SITE INSPECTION FIELD NOTES

(2)

Index

(3)

12/9/91

0954 - Arrive on site at BASF
1720 Dana Ave.
Cinti. Oh
ID# OHD 004 236 816
Gabe Root, PRC
Pat Zelinskas, PRC
Valerie Thomas, BASF
Angie Fornau, BASF
Weather: overcast, ~55°F
John Lesing, BASF

Facility operations - Admin. and manuf. for coatings at BASF interior + ext. varnishes for food + beverage cans.
In mont made same

(2)

Index

(3)

12/9/91

0954 - Arrive on site at BASF
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In mont made same

④ 12/9/91

products as BASF

The Norwood side of the RR tracks was coal storage area. Inmont was here from ~1926

Alton-Weiberg - 1913-1926 did the same processes

SWMUs

1) drum storage area ~10x25' 90-day area, concrete diked ~6" high on all sides used since ~1980, no cover sump located in SE corner valve for draining to City sewer to dump excess ~~Storm~~-water

⑤ 12/9/91

Bldg 13, ~~4A~~ GR 5 floors
5 satellite accumulation Areas

Bldg 28A - Resin building
3 sat. Acc Areas
(3 floors)

Bldg 31 + 26 4 SAcc. Areas

Bldg 4 - 1 sat. Acc. Area (on 2nd floor)

Bldg 3 - 1 sat. accum. Area

Bldg 18 - 1ab - sat. Accum Area

D001, F003 + F005 + D035 wastes were stored in these areas

Lab waste solvents, and batches, Manuf. operations -

⑥ 12/9/91

Produced D001, D035, F003 + F005

Filtering operations - filtering solid impurities out of products ~~producing~~

Hose cleaning, filtering operations - Stored on drum storage pad.

U122 - tank cleaned and tank waste sludges were removed - one time only - every few years.

None of the USTs stored hazardous wastes - Stored intermediate or finished goods

⑦ 12/9/91

UST Group #3

3 tanks 3 - comp (5,000 gal comp.

5 (see field copy)

Report from Fire Marshall has a record on size and material stored in each tank.

Bldg 28A - Process tank was used to store temp. HW (Jan. 1990) for tank truck to haul off-site

July 19, 1990 - 2:18 pm

The explosion occurred when a reactor got over pressured - relief valve released the vapor - Bldg 28 -

(8) 12/9/91

Vapor cloud ignited
Windows blown out
for couple blocks,
manuf. area destroyed
Fire alarmed pulled
When relief valve released
set-off the alarm
and 5-10 sec. later
exploded, - explosion
went N-S, east-west
nothing much happened
2 people killed, 70-80
emergency hospitalized, 20 hospit.
for longer period

Tumble to the North, +
Taco Casa damaged.
1/4 to 1/2 mile to the
South had glass damage

(9) 12/9/91

windows blown-out
~1/4 to 1/2 mile away

Removal - Remediation
from July 20 to Feb. 28
1990-1991 - by Heritage
Remed. - bricks, debris,
piping, reactors - misc.
equip - all material
in that central area
including group 2 + 13
(dotted lines on map)

Bldg B and remaining Bldgs
will be removed.
Material was analyzed
haz. materials - to Envirosafe Blending
non-haz. to Rumpke
Landfill.

(10) 12/9/91

Each waste load was evaluated.

GW Technology hired to invest. contam. soil near UST Group No. 3 tanks

PCB soil contam. North of Bldg 6, 9, 10. removed to Chem. Waste Model City, New York Landfill.

Phase II Jan. 1, 1992 - soil venting and bioremediation - (Ck. w/ Joe Schmidtrock OEPA)

Water was always come from City of Cincinnati Water Works

(11) 12/9/91

11:05 conclude pre-VSI meeting - begin site tour.

Photo 1 - drum storage Area ~12 drums - D001 ~~and 6K~~ demolition related wastes

#2-4 - Bld. 13

#5 - UST Group #2

#6 - view of site looking east near bldg 28

7, 8, 9 - PCB area removal and storm well for SW runoff

10 thru 11 - Drum Storage Area - 2 storm water drums at SE corner for release to MSD

12-20 Photos of overall site

(12)

12/9/91

All 5 ft buildings are being demolished by Bierlein Demolition and remaining bldgs. are expected to be removed in January 1992. Ground Water Technology will continue investigation of site.

11:45 Gabe Rood, PRC and Pete Zelinskas, PRC off-site - conduct VSI of BASF on Dana Avenue.

Gabriel J. Rood
12/9/91

(13)

BASF Inmont Corporation
1720 Dana Avenue
Cincinnati, Ohio 45207
513/841-6100

March 12, 1986

RCRA Activities
Region V
P.O. Box A3587
Attn: ATKJG
Chicago, Illinois 60690

Gentlemen:

I am enclosing the "Certification Regarding Potential Releases from Solid Waste Management Units" requested in your letter of January 30, 1986.

Very truly yours,

BASF CORPORATION
Inmont Division

Hugo D. Rasp
Director of Manufacturing

sf
enc.

CERTIFICATION REGARDING POTENTIAL RELEASES FROM
SOLID WASTE MANAGEMENT UNITS

NR

FACILITY NAME: BASF, Inmont Division

EPA I.D. NUMBER: OHD004236816

LOCATION CITY: Cincinnati

STATE: Ohio

1. Are there any of the following solid waste management units (existing or closed) at your facility? NOTE - DO NOT INCLUDE HAZARDOUS WASTE UNITS CURRENTLY SHOWN IN YOUR PART A APPLICATION

	YES	NO
° Landfill		X
° Surface Impoundment		X
° Land Farm		X
° Waste Pile		X
° Incinerator		X
° Storage Tank (Above Ground)		X
° Storage Tank (Underground)		X
° Container Storage Area		X
° Injection Wells		X
° Wastewater Treatment Units		X
° Transfer Stations		X
° Waste Recycling Operations		X
° Waste Treatment, Detoxification		X
° Other _____		X

2. If there are "Yes" answers to any of the items in Number 1 above, please provide a description of the wastes that were stored, treated or disposed of in each unit. In particular, please focus on whether or not the wastes would be considered as hazardous wastes or hazardous constituents under RCRA. Also include any available data on quantities or volume of wastes disposed of and the dates of disposal. Please also provide a description of each unit and include capacity, dimensions and location at facility. Provide a site plan if available.

NOTE: Hazardous wastes are those identified in 40 CFR 261. Hazardous constituents are those listed in Appendix VIII of 40 CFR Part 261.

3. For the units noted in Number 1 above and also those hazardous waste units in your Part A application, please describe for each unit any data available on any prior or current releases of hazardous wastes or constituents to the environment that may have occurred in the past or may still be occurring.

   Please provide the following information

   a. Date of release
   b. Type of waste released
   c. Quantity or volume of waste released
   d. Describe nature of release (i.e., spill, overflow, ruptured pipe or tank, etc.)

   None

4. In regard to the prior or continuing releases described in Number 3 above, please provide (for each unit) any analytical data that may be available which would describe the nature and extent of environmental contamination that exists as a result of such releases. Please focus on concentrations of hazardous wastes or constituents present in contaminated soil or groundwater.

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the submittal is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations. (42 U.S.C. 6902 et seq. and 40 CFR 270.11(d))

Hugo D. Rasp, Director of Manufacturing
Typed Name and Title

Signature

3/12/86
Date

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the submittal is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations. (42 U.S.C. 6902 et seq. and 40 CFR 270.11(d))

James C. Yorko, Sr. Manager
Typed Name and Title

James C Yorko Sr
Signature

3/7/86
Date

REV 8-1-85

CONTINUING RELEASES AT PERMITTED FACILITIES

SEC. 206. Section 3004 of the Solid Waste Disposal Act is amended by adding the following new subsection after subsection (t) thereof:

"(u) CONTINUING RELEASES AT PERMITTED FACILITIES.—Standards promulgated under this section shall require, and a permit issued after the date of enactment of the Hazardous and Solid Waste Amendments of 1984 by the Administrator or a State shall require, corrective action for all releases of hazardous waste or constituents from any solid waste management unit at a treatment, storage, or disposal facility seeking a permit under this subtitle, regardless of the time at which waste was placed in such unit. Permits issued under section 3005 shall contain schedules of compliance for such corrective action (where such corrective action cannot be completed prior to issuance of the permit) and assurances of financial responsibility for completing such corrective action.".

D-8J

January 29, 1999

Mr. Christopher M. Budich
Division of Hazardous Waste Management
Southwest District Office
Ohio EPA
401 East Fifth Street
Dayton, Ohio 45402-291

Re: BASF Corporation, OHD 004 236 816

Dear Mr. Budich:

Thank you for your letter of December 20, 1998, outlining the actions taken at the BASF Corporation Dana Avenue facility. I have reviewed your conclusions and the summary report from Fluor Daniel GTI dated November 5, 1998. I concur with your conclusions that based on currently available information the Dana Avenue facility no longer appears to present a risk to human health and the environment. Please proceed with your development of a letter to inform BASF that they have fulfilled applicable RCRA Subtitle C corrective action requirements.

I am impressed by the ability of your Agency to provide the appropriate level of oversight and technical assistance to enable BASF to achieve a successful voluntary environmental clean-up of the Dana Avenue facility. Let me congratulate you and BASF on this innovative and effective approach to environmental protection.

Sincerely,

Gerald W. Phillips
Corrective Action Process Manager
Waste, Pesticides and Toxics Division

cc: Dave Sholtis, OEPA, DHWM/CO
File

OhioEPA
State of Ohio Environmental Protection Agency

Southwest District Office

401 East Fifth Street
Dayton, OH 45402-2911

TELE: (937) 285-6357 FAX: (937) 285-6249

George V. Voinovich, Governor
Nancy P. Hollister, Lt. Governor
Donald R. Schregardus, Director

December 20, 1998

RE: BASF CORPORATION
CORRECTIVE ACTION
OHD 004 236 816

Mr. Gerry Phillips
USEPA Region 5
Waste, Pesticides and Toxics Division
77 West Jackson Boulevard
Chicago, Illinois 60604-3590

Dear Mr. Phillips:

Please find attached Ohio EPA's conclusions concerning the remedial action undertaken by BASF Corporation in their effort to satisfy their applicable RCRA Subtitle C corrective action requirements for the former Dana Avenue facility in Cincinnati, Ohio OHD 004 236 816. Also attached is an executive summary provided by BASF Corporation.

Upon review and approval of the above mentioned documents by USEPA, Ohio EPA requests a response documenting USEPA's concurrence with the remedial actions at the Dana Avenue facility and Ohio EPA's conclusions regarding these actions.

Once provided with USEPA's concurrence, Ohio EPA will issue a letter to BASF Corporation informing them that they have fulfilled applicable RCRA Subtitle C corrective action requirements for the Dana Avenue facility. Please be advised that this site is neither permitted or under Director's Orders to conduct these activities.

Should you have any questions concerning the above, please contact me at (937) 285-6083.

Sincerely,

Christopher M. Budich

Christopher M. Budich
Division of Hazardous Waste Management

cc: Dave Sholtis, OEPA, DHWM/CO

Ohio EPA DHWM Southwest District Office
Summary of Review and Conclusions
Re: BASF Corporation Dana Avenue Facility
OHD 004 236 816

Operations at the BASF Dana Avenue facility ceased following an explosion and fire in July of 1990. Some site investigation had begun prior to the fire and continued afterward. Initial investigation was to evaluate the characteristics of the soils and groundwater underneath the facility. Subsequent investigations were performed to evaluate the potential impact to soil and groundwater as a result of the explosion and firefighting efforts at the facility. In the Fall of 1991 Ohio EPA Division of Emergency and Remedial Response (DERR) was contacted by BASF to provide oversight of the remedial activities at the site. DERR provided limited oversight which included preliminary review of workplans provided by BASF. The workplans submitted addressed remedial activities which included soil removal, soil treatment, and installation of an SVE system. In 1996 BASF entered into an agreement with Ohio EPA to conduct additional investigative activity and complete a risk assessment for the site.

After evaluating their options, BASF proposed to complete activities to satisfy RCRA Subtitle C corrective action obligations. Ohio EPA's Division of Hazardous Waste Management (DHWM) agreed to provide oversight of these activities. DHWM met with BASF to determine what additional samples would be required and what ares these samples would address. After reviewing the PRVSI conducted in December of 1991 by a USEPA contractor, and previous investigation reports provided by BASF, six solid waste management units (SWMUs) were identified. In September of 1997 BASF provided Ohio EPA with a field sampling and analysis plan to address additional data needs in support of the risk assessment. Based on the results of this sampling effort additional soil removal was conducted. Per Ohio EPA's request this additional investigation addressed areas containing sumps and drainage lines associated with the SWMUs.

In addition to data collection, these investigations served to characterize the hydrogeologic setting under the site. All information pertaining to the hydrogeology was reviewed by Ohio EPA's Division of Drinking and Ground Water (DDAGW). Results of these investigations defined two hydrogeologic zones associated with the site. The subsurface below the former production area consists of approximately 3 feet of fill overlying a glacial till. The glacial till is described as an upper clay layer and a lower silt and clay layer. Ground water found within the till unit occurs in discrete locations and appears to be perched in nature. The second zone is north of the former production area. This zone consists of an approximately 30 foot sand unit beneath the glacial till. The sand unit exist to depths of approximately 80 feet below ground surface and is associated with the Norwood Trough. Hydraulic conductivity measurements of the glacial till indicated values on the order of 1x10-6 to 1x10-8 cm/sec.

Ground water quality data from three wells indicated results exceeding MCLs. Two of the wells had detections of chlorinated compounds. These particular compounds had no historical use at

the site. The locations of these two wells were at the property boundary and BASF proposes that the results indicate background conditions. No evidence of these compounds were detected in the soil borings at the site. The third well detected site compounds (xylenes and ethyl benzene) above the MCLs. Other wells in the vicinity did not detect these compounds supporting BASFs conclusion that compound migration is minimal under the site due to the low hydraulic conductivity and the discontinuous nature of the ground water under the site. Citing the above reasons and the fact that there are local restrictions regarding usage of the ground water (requirement to hook up to Municipal water) BASF proposed to eliminate the ground water pathway from consideration in the baseline risk assessment (BRA). Ohio EPA concurs with this proposal.

The initial BRA submitted in May of 1998 was revised in September of 1998 to include all additional sampling results obtained subsequent to removal of hotspots in the SWMU areas. The BRA evaluates exposures to soil contaminants based on a future residential use scenario. An initial screening of contaminants was conducted using generic standards from Ohio EPA's Voluntary Action Program (VAP). DHWM requested that BASF screen using the standards from USEPA Region 3 PRGs. Results of both screenings were included in the BRA with the VAP numbers being a more conservative approach. In addition, DHWM requested that BASF perform risk calculations for two areas without screening potential constituents of concern as a demonstration that their screening approach was indeed conservative. The BRA addressed both adult and child exposures. The results of the BRA for exposure to residual soil contaminants were below the DHWM risk goal of 1x10-5 for carcinogenic effects and a hazard index of 1 for non-carcinogenic effects.

While not required by Ohio EPA, BASF has proposed to impose a deed restriction on the property limiting future use to commercial activities. This area has been targeted by the City of Cincinnati for redevelopment. Based on the extensive investigation and the results of the BRA Ohio EPA DHWM/SWDO recommends that no further remedial action be taken at the site. Ohio EPA DHWM/SWDO concludes that BASF has satisfied their RCRA Subtitle C corrective action obligations.

FLUOR DANIEL GTI

November 5, 1998

Mr. Chris Budich
Ohio EPA
Division of Hazardous Waste Management
401 E. Fifth Street
Dayton, Ohio 45402-2911

Subject: **BASF Dana Avenue Facility**
Executive Summary of Remedial Actions and Risk Assessment

Dear Mr. Budich:

Enclosed please find an Executive Summary of Remedial Actions and Risk Assessment which you requested be prepared to assist you in moving the site forward toward RCRA closure. The document summarizes sampling and remedial efforts, and presents a summary of the Baseline Risk Assessment.

Please review this information and give me a call if you have any questions or comments. We look forward to our upcoming meeting on November 10 to discuss this and other closure issues.

Sincerely,
Fluor Daniel GTI

Raymond Nowak
Project Manager

cc: Rudy Trinks, BASF

6573-T Cochran Road / Cleveland, OH 44139 USA (440) 349-0004 FAX (440) 349-0894

FLUOR DANIEL GTI

BASF DANA AVENUE FACILITY
SUMMARY OF REMEDIAL ACTIONS AND RISK ASSESSMENT
BASF CORPORATION
DANA AVENUE FACILITY
CINCINNATI, OHIO

November 5, 1997

Prepared for:

BASF CORPORATION

Mr. Rudolph H. Trinks, P.E.

3000 Continental Drive North

Mount Olive, NJ 07828-1234

Prepared by:

FLUOR DANIEL GTI

6573-T Cochran Rd.

Solon, Ohio 44139

BASF has undertaken a number of environmental investigations and remedial actions at the Dana Avenue facility in Cincinnati, Ohio since approximately 1990. This document briefly summarizes the investigations and remedial actions, and also presents a summary of the baseline risk assessment which was performed following the last of the remedial actions. The data and risk assessment analysis establishes that the remedial actions have brought the site to acceptable closure levels and that no further action is required for the facility.

1.0 PREVIOUS REPORTS

The bulk of the information regarding the investigations was presented in the following reports prepared by Groundwater Technology, Inc. (now Fluor Daniel GTI):

- BASF Facility Site Investigation Report, dated July 3, 1991
- Report on Assessment of Soil Conditions Along the Railroad Spur Area at the BASF Corporation Facility in Cincinnati, Ohio, dated April 23, 1991
- Site Investigation Report, BASF Corporation 1720 Dana Avenue, Cincinnati, Ohio, dated July 15, 1992
- Railroad Spur Area Supplemental Assessment Report, dated August 30, 1993

Two reports have been prepared to address remedial construction activities:

- Phase I Remediation, Ambient Air Monitoring Report, dated April 25, 1994
- Phase II Construction Report, October - November, 1994, dated May 30, 1996

A summary report was prepared to document the investigations and remedial actions through the end of 1996. This summary report presented the results of all analytical samples taken up to that time, and served as the basis for discussions with the Ohio EPA regarding the RCRA closure of the site:

- BASF Corporation Dana Avenue Facility, Summary of Investigations and Remedial Actions and Sample Summary Report, dated August 17, 1997

Discussions with the Ohio EPA in August, 1997 resulted in the production of two additional documents, one a work plan describe final sampling activities which would be performed, and another a summary of all groundwater information which had been obtained at the site:

- Field Sampling and Analysis Plan, BASF Corporation Dana Avenue Facility, Cincinnati, Ohio, dated September, 1997

- Groundwater Monitoring Report, BASF Corporation Dana Avenue Facility, Cincinnati, Ohio, dated September, 1997

Lastly, a Baseline Risk Assessment report was prepared based on the results of the samples obtained following the implementation of all remedial actions:

- Baseline Risk Assessment, BASF Corporation Dana Avenue Facility, Cincinnati, Ohio, dated September 17, 1998.

In addition to these reports, the Agency for Toxic Substances and Disease Registry (ATSDR) prepared a health consultation for the facility dated August 12, 1997. The health consultation was requested by a local citizens group. The consultation concluded that "the chemical concentrations in air, water, and soil that people may potentially be exposed to are not of public health concern". Copies of the ATSDR report were provided to the Ohio EPA and local officials from the City of Cincinnati.

2.0 SUMMARY OF INVESTIGATIONS

The documents described above present detailed descriptions of the sampling programs conducted at the site since approximately 1990. Pertinent conclusions drawn from the investigations are as follows:

- In general, the subsurface geology consists of a thin fill unit which overlies a glacial slit/clay unit. The fill is usually less than three feet thick. The glacial silt/clay extends to a depth of thirty to 40 feet below grade in the northern portion of the site (north of the railroad right-of-way), where it overlies a sand deposit. In the southern portion of the site, the glacial silt/clay directly overlies bedrock. At its maximum thickness the glacial silt/clay extends to a depth of approximately 30 feet in the southern portion the property. However, at many locations the bedrock is much closer to the surface and the glacial silt/clay extends to only approximately 10 feet below grade before bedrock is encountered.

- The glacial silt/clay has a low hydraulic conductivity. Laboratory measurements of vertical permeability ranged from 10^{-6} to 10^{-9} centimeters per second (cm/s). The low permeability of this unit acts to inhibit the downward migration of organic constituents which were present within the fill or from other near surface sources, particularly the tank groups.

- A perched groundwater zone can be present within the fill, and groundwater is also present within the glacial silt/clay. Due to the low hydraulic conductivity of this

unit, groundwater movement within the silt/clay is very low. Groundwater is also present within the sand underlying the silt clay in the northern portion of the study area at a depth of approximately 75 to 80 feet below grade.

- Elevated concentration of organic constituents were detected at some locations in the fill and in the upper few feet of the glacial silt/clay. The primary constituents detected include toluene, ethylbenzene, xylenes, and naphthalene. In the vicinity of the tank groups, other volatile organics such as acetone, methyl ethyl ketone (MEK), and methyl iso butyl ketone (MIBK) were also detected. In the railroad spur area, primary constituents detected include toluene, ethylbenzene, xylenes, naphthalene, and various PAH constituents.

- In general, there has been limited downward migration of contamination throughout the site. This is attributed to the low permeability of the silt/clay unit. For example, significant concentrations of organic constituents were found within the Tank Group 2 backfill prior to remediation, but soil samples obtained a few feet below the tank group show that the native soils contained very low to non-detected levels of organic constituents.

- Two of the monitoring wells installed on the BASF property displayed concentrations of organic constituents above drinking water criteria. One well is MW-7S, which is screened at the glacial silt/clay and bedrock interface in the southwest corner of the site along Dana Avenue. The second well is MW-11D, which was installed during the 1994 supplemental investigations. Both of these wells contained low levels of chlorinated organic compounds.

3.0 SUMMARY OF REMEDIAL ACTIONS

Based on the compounds detected and the geologic and hydrogeologic conditions, several remedial actions were undertaken at the facility. Remedial actions were taken in four phases, beginning in December, 1993 and ending in May, 1998. Complete descriptions of the actions taken are provided in the previous reports. This section presents a summary of these actions.

3.1 Phase I Remedial Actions

3.1.1 Central Excavation Area

The central portion of the southern half of the site was found to contain elevated levels of toluene, ethylbenzene, and xylenes during the investigation. This area is where the main processing facilities were during the plant's operation. A number of remedial options were considered to

address the soils in this area. Performing in-situ soil vapor extraction was ruled out based on the low permeability of the soils and the presence of a number of basement foundations, which inhibit the flow of air in the subsurface. Performing in-situ biological treatment was also ruled out due to the subsurface structures and the low permeability of the soils.

The technology selected for the area was to excavate the soils and treat them in an above ground soil vapor extraction pile built on site. Approximately 2,200 cubic yards of soil were excavated and were placed into the pile in December, 1993. The majority of the soil was taken from the central excavation area, with a small amount being taken from an elevated railroad berm located just north of the central excavation area. The pile was lined with perforated pipe, and the pipes were connected to a vapor extraction blower.

Beginning in March, 1994, vapors from the pile were removed with a soil vapor extraction blower and were treated using a thermal oxidizer before discharge to the atmosphere. This process was carried out through April, 1996, when it was determined that the on-site technology had reached the limit of its effectiveness.

In April, 1996, the soils in the pile were removed and sent to the Petro Environmental Technologies facility in Washington Courthouse, Ohio for final polishing treatment and disposal. The facility provides biological treatment of petroleum contaminated soils (PCS) on a commercial scale, and operates under applicable permits with the Ohio Environmental Protection Agency (OEPA). The soils were loaded into a cell for supplemental final treatment, and will be ultimately used as cover in the Fayette County landfill.

3.1.2 Railroad Right-of-Way Pilot Dual Phase Extraction System

The investigations showed that the railroad right-of-way contained elevated levels of some constituents, including toluene, ethylbenzene, xylenes, and naphthalene in soils and groundwater. In addition, less mobile polynuclear aromatic hydrocarbons (PAHs) were detected in the soils.

The physical data showed that the subsurface consisted of approximately 6-10 feet of fill overlying the glacial silt/clay. The chemical samples indicated that contamination was confined to the soil and groundwater in the fill, and that the glacial silt/clay underneath the fill contained low contaminant concentrations.

The remediation technology selected for the railroad right-of-way was to perform dual phase high vacuum vapor extraction (DPVE). During Phase I remediation, a pilot system was installed along a 250 foot stretch of the right-of-way immediately north of the former manufacturing area.

The pilot system consisted of 11 combined vapor extraction/dewatering points. These points were

hooked into a common header system and piped to a liquid ring blower. The effluent from the liquid ring blower was combined with the exhaust from the soil vapor extraction pile and was passed through the thermal oxidizer prior to discharge to the atmosphere.

Groundwater collected by the liquid ring blower is passed through carbon prior to discharge to the MSD in accordance with the industrial wastewater discharge permit issued for the site (Permit no. ML-105).

The pilot DPVE system began operations in March, 1994 and continued through August, 1994. The right-of-way had been dewatered, and an additional source of water was necessary to cool the liquid ring pump. The water source was installed following the Phase II construction effort in December, 1994, and the system was brought back on-line in March, 1995.

The pilot DPVE technology showed a good radius of influence and volatile removal rate. Therefore, the pilot system was expanded to address the remaining railroad property traversing the site in 1996.

3.1.3 Tank Group 2

The backfill within Tank Group 2 contained elevated levels of volatile organics, including methylated benzene compounds, toluene, ethylbenzene, and xylenes. The data also showed that the compounds were located in the pea gravel backfill only. The glacial silt/clay underlying the backfill displayed very little evidence of volatile organic compounds, due to the low permeability of the glacial silt/clay unit.

The remedial action in Tank Group 2 consisted of installing two flexible soil vapor extraction lines along the length of the excavation from east to west. The lines were installed by excavating a trench within the pea gravel backfill to the base of the tank group, and extending the lines out of the top of the tank group on both sides to the surface. The pea gravel within the group was then covered with clayey backfill brought from off-site.

Beginning in April, 1996, air was alternately injected and withdrawn through the flexible lines using the soil vapor extraction blowers. Withdrawn air was treated in the thermal oxidizer before discharge to the atmosphere. The operation was conducted through September, 1997, when air sampling data indicated that the technology had reached the limits of its effectiveness and the operations were ceased.

3.2 Phase II Remedial Activities

Phase II remediation took place between October, 1994 and November, 1994. The activities during this phase were designed to regrade and stabilize the site, and to address areas of concern not

included in Phase I.

3.2.1 Central Excavation Area / Site Regrading

The main activity undertaken during Phase II was to regrade the site, allowing for a stabilized land surface which could be left in place while determinations on property usage were finalized. To regrade the site, it was necessary to fill in basements of several buildings which had been left open following site demolition (buildings #6, #10, #13, and #18). In addition, as the basements were filled it was necessary to establish a final grade on the southern portion of the property to direct rainfall runoff away from the two roads bordering the southern portion of the property, Dana Avenue to the south and Montgomery Avenue to the east.

Backfill was purchased and brought on-site to fill in the basements, and to establish the final grade of the southern portion of the property. A total of 1,966 tons of bank run sand, and 9,253 tons of clayey backfill were emplaced in two foot lifts in the building basements and in other areas where necessary to establish final grade. Modified proctor testing was performed during the operation to ensure that the backfilled areas had the requisite structural stability for future development.

In conjunction with establishing the final grade, all of the remaining concrete slab was collected and disposed off-site at the ELDA facility. Also, former basement foundations were cut to two feet below final grade and the concrete was also disposed at the ELDA facility.

Prior to backfilling the basements, the basement floor slabs were broken into 2 foot sections to promote future drainage, as requested by the Cincinnati Department of Buildings. Also, soil samples were taken from beneath the floor slabs to determine the nature of the subsurface prior to backfilling.

After establishing final grade on the southern portion of the property, the eastern half of the northern portion was regraded as well. A small rise located just north of the railroad right-of-way was cut back and the soils under the rise were spread out to the west, to achieve a smooth transition between the northeast and northwest portions of the property. Railroad ties which were present within the small rise were removed, stockpiled, and disposed of at the ELDA facility.

3.2.2 Install New Sewer Line

In association with the site regrading which routed all drainage away from Dana and Montgomery Avenues from the southern portion of the property, it was necessary to address the collection of storm water runoff for the long term. Therefore, a new storm sewer was installed during Phase II.

The storm sewer line consists of 12-inch to 24-inch diameter ductile iron pipe. A total of eight pre-cast concrete manholes were installed along the length of the line. The line was installed at an

average depth of approximately four feet below grade, and was installed an average of three feet to the south of the railroad right-of-way on the BASF property. Verification of the line installation was made by a professional surveyor.

During construction of the line, it was necessary to remove a portion of the berm area adjacent to the right-of-way to facilitate construction. Soils removed from the berm area, and soils generated while trenching to install the sewer line, were separately stockpiled. These soils exhibited elevated PID readings based on field head space readings, and were transferred to Tank Group 12 to be treated with the backfilled soils in this area.

A pump was installed in the downgradient manhole from the sewer line and a new connection was made to an MSD outfall located along the western edge of the BASF property grade slab. The line was heat traced and jacketed in areas where potential freezing problems could occur.

The treated water from the pilot DPVE system installed in the railroad right-of-way during Phase I discharged into a sewer outfall in the central area of the BASF property. After the area was regraded, it was necessary to move this discharge point to the new storm sewer installed during Phase II.

3.2.3 Tank Group 12

BASF removed the tanks in Tank Group 12 in May, 1993. The tanks and contents were disposed off-site, while the backfill surrounding the tank group was replaced in the excavation and the excavation was covered with viscuene and sand. The soils within Tank Group 12 were addressed during Phase II.

During the investigations performed in the summer of 1994, the groundwater and soil samples taken outside of the tank group showed that contamination had not migrated out of the group into the surrounding subsurface. Therefore, Phase II remediation addresses only the tank backfill soils within the confines of the tank group itself, and remedial actions were not necessary outside of the group.

Remediation consisted of removing and stockpiling the backfill. The stockpiled soils were mixed with soils excavated during the installation of the storm sewer and were allowed to dry for several days to make them workable. After the soils had dried sufficiently, they were replaced in the excavation. The soils were emplaced in two foot lifts, and were compacted as the lifts were installed. The area backfilled to match the final grade established for the site.

To facilitate remediation, two rows of horizontal vapor extraction lines were installed while backfilling on 10 foot off-set centers. The horizontal lines were piped to the surface where a header line was installed connecting the backfilled tank group to the equipment compound.

Remediation was initiated in this tank group by alternately withdrawing and injecting air into the lines installed during backfilling. During air withdrawal periods, vapors were treated in the thermal oxidizer before discharge to the atmosphere. The system was operated through approximately September, 1997, when air samples showed that the VOC exhaust levels had decreased and that the technology had reached the limits of its effectiveness.

3.2.4 Topsoil and Seeding

As the final activity of Phase II remediation, a portion of the southern and northern portions of the BASF property which were regraded were topsoiled and seeded. A four-inch thick layer of topsoil was provided throughout the entire area, and industrial grade Kentucky # 31 grass seed was applied. Straw was applied on top of the grass seed for erosion control over the winter months. The operation was a dormant seeding, and grass growth began in the spring of 1995. The seeded area is now covered with grassy vegetation.

3.3 Phase III Remedial Activities

3.3.1 Expanded Railroad DPVE System

The pilot DPVE system indicated an acceptable radius of influence (approximately 25 ft./point) and significant VOC removal rates, therefore this technology was expanded to address the remainder of the railroad property from the western edge of the pilot system to Dana Avenue. Thirty-two additional extraction wells were installed in June, 1996 to address the approximate 900 feet of railroad property between the existing pilot system and Dana Avenue. A new blower was purchased and installed in November, 1995 to address this additional airflow. The new blower was connected to the expanded system in July, 1996. The system was operated alternately in the air injection and air withdrawal modes until approximately November 1997, when the air effluent data indicated that VOC levels had been substantially reduced. Since November 1997 the system has been operated in the air injection mode. When the system was operated in the air withdrawal mode, vapors were treated on the thermal oxidizer and recovered water was treated with carbon and discharged to the MSD.

3.4 Final Remedial Activities

A site wide soil sampling program was performed in October and November, 1997 in accordance with the Field Sampling and Analysis plan approved by the Ohio EPA. The results of the soil sampling indicated two areas of potential concern:

(1) Elevated VOC concentrations were observed in three of the borings conducted in the Tank Group 12 SWMU.

(2) An elevated concentration of bis 2 ethylhexylphtlalate was found near soil boring CSB-52 located north of the railroad SWMU.

In addition, the Ohio EPA had expressed concern to BASF over sewers which remained on site following demolition activities. Although the October and November, 1997 sampling revealed no elevated VOC readings near to the sewer line, and although the line had been plugged in place and abandoned, BASF desired to investigate the line through an excavation program to determine if potentially problematic subsurface soils were associated with the sewer line.

On June 2, 1998, an excavation was conducted and an eight inch diameter clay tile pipe was uncovered at a depth of 8 feet. To address this sewer line, a east-west trench was excavated along the length of the sewer line for approximately 250 feet west of the location of CSB-39. The top 8 feet of clay was segregated from the actual clay pipe and immediate backfill. The clay fill around the sewer line was stained black to grey and exhibited distinct chemical odor. The soil was segregated into impacted and non-impacted piles based on visual appearance, odor and PID readings. The determination was made to remove impacted soils from the site, and transport and dispose of those soils at the Petro Environmental Technologies facility in Washington Courthouse, Ohio. Petro had previously treated other soils generated at the site, including soils from the above ground enhanced soil vapor extraction pile that were removed in 1994. Non-impacted soils were to be backfilled into the excavation based on analytical data, with clean fill placed on top of these soils to restore the site.

To determine quality of the soils remaining in the excavation, samples were collected from the native soil below the sewer line after excavation had stopped at a depth of 9 feet below grade. In addition, the soil which was taken off site was sampled and analyzed, as was the soil which was brought in to backfill the trench excavation.

On June 3 and June 4, 1998, excavation activities were conducted in the northern end of the Tank Group 12 SWMU where borings with elevated VOC concentrations were observed. The excavation was conducted to remove soils on the basis of visual observations and field PID readings. Potentially impacted soils were transported off site to the Petro Environmental treatment cell. Non-impacted soils were backfilled into the excavation, and clean fill was brought in to restore the final grade. Analytical samples were obtained of the sides and bottom of the excavation, of the material taken off-site, and of the material brought back on-site to backfill the excavation.

In addition, on June 4, 1998, approximately 25 tons of soil were removed from the vicinity of one soil boring which showed an anomalously high level of bis 2 ethylhexylphthalate. The excavation extended three feet deep where non-stained material was noted. Excavated soils were transported to the Petro Environmental facility.

During these excavation activities in June of 1988, a total of approximately 1210 tons of soil was transported to Petro Environmental for disposal. An equivalent amount of clean fill was brought back on site to backfill and grade the excavations.

4.0 FINAL SAMPLING RESULTS

Final soil sampling results based on samples taken in October and November, 1997, along with the final post excavation samples taken in June, 1998, are presented in the September, 1998 Baseline Risk Assessment, summarized in Section 5 of this report. The soil data show that the remedial actions have been very successful at removing elevated VOCs where they occurred in soils around the site. The vast majority of soil samples show non-detect VOC concentrations. Those locations which do show detectable VOC concentrations generally display low levels, in most cases less than 1 part per million.

Final groundwater sampling results are discussed in the September, 1997 Groundwater monitoring report. Historically, two monitoring wells (MW-7S and MW-11D) displayed low levels of chlorinated organic compounds which exceeded MCLs. Monitoring well MW-7S is located in the south west corner of the site along Dana Avenue and is screened within the upper clay layer, partially into the underlying silt and clay layer, and immediately above bedrock. Monitoring well MW-11D is located in the northeast corner of the site at the corner of Montgomery and Lexington and is screened in the deep sand layer encountered below the silt and clay layer.

Because of their locations and hydrogeologic settings, wells MW-7S and MW-11D are likely to represent background groundwater quality conditions. The chlorinated organic compounds detected in these wells are most likely from unknown offsite sources up gradient of the site. This is based on the fact that soil sampling in both borings detected no chlorinated organic compounds in the soil column at either location. In addition, chlorinated organics were detected only rarely in soil samples taken throughout the site, with the maximum detected concentration being approximately 10 ppb of TCE.

Two wells located in the railroad property, B3MW-2 and SW-6, display low concentrations of VOCs (B3MW-2; ethylbenzene, total xylenes, SW-6; chlorinated organic compounds) exceeding the OEPA MCLs for drinking water. Because both of these wells are screened in the upper clay layer (low permeability) and have low concentrations of organic constituents detected, the horizontal and vertical migration of impacted groundwater is not extensive, resulting in a limited area of impact. A downgradient well located at the property line, B3MW-1, contains VOCs but at concentrations below MCLs, supporting the limited migration of groundwater. The railroad right-of-way has been remediated through the DPVE system, effectively removing remaining source areas.

Based on these conclusions, it is recommended that no further groundwater remediation is necessary.

5.0 BASELINE RISK ASSESSMENT SUMMARY

A Baseline Risk Assessment (BRA) was prepared following all remedial activities at the facility. The BRA investigated the potential for chemicals originating at the site to affect public health, either now or in the future. A baseline ecological risk assessment is not required for this site because of the heavily industrialized / urbanized nature of the facility and surrounding area and the very limited potential for sensitive ecological habitats to be adversely affected. Therefore, the BRA focused on potential human health risks. The BRA was prepared in accordance with applicable Ohio EPA and U.S. EPA guidance.

The BRA was prepared by selecting chemicals of potential concern (COPCs) in each area of interest by evaluating chemicals that were detected as to whether they did or did not significantly contribute to the risk estimates, or whether their presence could be attributable to native or background conditions. Sixty chemicals were detected in one or more of the eight areas of interest, including 21 metals. Of these 60 chemicals, ten were retained for quantitative evaluation in one or more areas of interest for the soil direct contact exposure route. The COPCs selected for this route of exposure included benzene, six potentially carcinogenic PAHs, bis(2-ethylhexyl)phthalate, beryllium, and manganese.

Based on the site history it is believed that beryllium and manganese are not site-related, however they were initially retained for further evaluation in one area (in the North of the Railroad non-SWMU area) due to one anomalously high concentration in one subsurface soil sample for each of these metals. However, seven additional confirmatory soil samples were collected in the vicinity of this anomalous soil sample and all confirmatory samples showed beryllium and manganese concentrations within background ranges. However, for consistency, even though these two metals were below background, they were still retained for risk-based evaluation via subsurface exposure routes.

Twelve of the 60 chemicals detected in soils were retained for evaluation via the soil leaching to groundwater exposure route in one or more areas. Acetone, benzene, methylene chloride, styrene, 2-methylnaphthalene, 2-methylphenol, benzo(a)anthracene, benzo(b)fluoranthene, isophorone, naphthalene, 1,3-dichlorobenzene, lead, and manganese were identified as preliminary COPCs as a result of leach-based criteria in one or more areas. None of these constituents, except lead and manganese which are ubiquitous, were detected in groundwater in 1997.

Ten chemicals were detected in one or more of the 35 monitoring well groundwater samples collected in 1997. Ethylbenzene was detected in six samples, xylenes were detected in four samples, and trichloroethene was detected in three samples. The other seven chemicals (chloroform; 1,1-dichloroethane; cis-1,2-dichloroethene; trans-1,2-dichloroethene; carbon tetrachloride; tetrachloroethene; and vinyl chloride) were detected in two or less wells, and when detected were generally found at low levels (10 - 100 ppb). Evaluation of the groundwater pathway indicates that the affected groundwater is discontinuous, that groundwater does not represent a viable water resource due to low yield, that potable water is supplied municipally, and that local regulations regarding physical well requirements are not conducive for the installation of new wells for potable use. For these reasons, the groundwater exposure pathway was removed from quantitative evaluation in the BRA.

Based on the likely future use of the property, the most likely receptors for the site are workers involved in routine above ground activities, and construction workers who could be potentially exposed to subsurface soils. Exposure pathways for both of these types of workers include incidental ingestion of soil, dermal contact with soil, and inhalation of fugitive dusts and volatiles in ambient air. For construction workers, potential exposure also included soils ranging in depth from zero to 15 feet in accordance with Ohio EPA RCRA Guidance (1993).

Although future residential use of this property is extremely unlikely, potential risks associated with such use were evaluated in the BRA in accordance with Ohio EPA RCRA guidance (Ohio EPA, 1993). Potential receptors consist of an adult and a child resident. Potential exposure pathways for soil consist of incidental ingestion and dermal contact, inhalation of fugitive dusts in ambient air, and inhalation of volatiles in indoor air. For purposes of this assessment and following Ohio EPA RCRA Guidance (1993), surface soil exposures were considered for all soils ranging in depth from zero to two feet below ground surface.

Primarily Ohio EPA Guidance (1993) default exposure values were utilized in estimating carcinogenic and non-carcinogenic human health effects for the identified receptors and exposure pathways for soils. Soil carcinogenic health effect estimates for the eight areas of interest and the four receptors are as summarized below:

Carcinogenic Risk Estimates

	Adult Worker	Construction Worker	Adult Resident	Child Resident
Tank Group 3	5×10^{-7}	1×10^{-9}	8×10^{-7}	1×10^{-6}
Central Excavation	2×10^{-8}	9×10^{-10}	3×10^{-8}	5×10^{-8}
Building 33	$<1 \times 10^{-6}$	$<1 \times 10^{-6}$	$<1 \times 10^{-6}$	$<1 \times 10^{-6}$
Tank Group 2	$<1 \times 10^{-6}$	$<1 \times 10^{-6}$	$<1 \times 10^{-6}$	$<1 \times 10^{-6}$
Railroad	4×10^{-7}	3×10^{-9}	6×10^{-7}	1×10^{-6}
Tank Group 12	$<1 \times 10^{-6}$	5×10^{-11}	$<1 \times 10^{-6}$	$<1 \times 10^{-6}$
North of Railroad	$<1 \times 10^{-6}$	9×10^{-9}	$<1 \times 10^{-6}$	$<1 \times 10^{-6}$
South of Railroad	$<1 \times 10^{-6}$	$<1 \times 10^{-6}$	$<1 \times 10^{-6}$	$<1 \times 10^{-6}$

Target carcinogenic risk estimates were set at 1×10^{-5}. Although residential exposure carcinogenic risk estimates were calculated, the most realistic future use of the site is for commercial or industrial development. These land uses are most likely to represent actual future soil exposures. Carcinogenic risk estimates shown as "$<1 \times 10^{-6}$" indicate that no carcinogenic COPCs were retained in that specific area, or that no COPCs were present in the soil horizon considered for the exposure route (e.g., surface soil).

Noncarcinogenic health effect estimates from exposure to soils in the eight areas of interest and the four receptors are:

Noncarcinogenic Risk Estimates

	Adult Worker	Construction Worker	Adult Resident	Child Resident
Tank Group 3	<1	<1	<1	<1
Central Excavation	<1	<1	<1	<1
Building 33	<1	<1	<1	<1
Tank Group 2	<1	<1	<1	<1
Railroad	0.0006	0.00003	0.0009	0.008
Tank Group 12	<1	1×10^{-8}	<1	<1
North of Railroad	<1	0.0049	<1	<1
South of Railroad	<1	<1	<1	<1

Target noncarcinogenic health-effect estimates were set at a hazard index of 1. Although residential exposure noncarcinogenic risk estimates were calculated, the most realistic future use of the site is for commercial or industrial development. These future land uses represent the most likely to represent actual future soil exposures. Noncarcinogenic hazard index estimates shown as "<1" indicate that no noncarcinogenic COPCs were retained in that specific area, or that no noncarcinogenic COPCs were found in the soil horizon considered for the exposure route (e.g., surface soil).

The conclusions of the BRA are as follows:

- Potential exposure to surface and subsurface soil in all areas of the site under the most likely future uses (commercial or industrial) are unlikely to result in unacceptable risks to human health. All risk estimates for any receptor exposed daily to surface soil were less than 1×10^{-5}. In fact, risk estimates for all receptors were below 1×10^{-6} for all areas. All risk estimates for a construction worker exposed to soil up to 15 feet deep were also below 1×10^{-6}. Non-cancer hazard indices for all receptors were less than one (1.0) in all areas. Consequently, further remediation to protect future exposure to soil constituents under a commercial, industrial, or residential land use is not necessary.

- Four organic constituents were detected in recent groundwater sampling above drinking water standards. Only four wells contain these constituents, and these are located in three widely separated areas. Two of the wells potentially represent background (non-site related) groundwater quality. A quantitative analysis of these constituents was not necessary because the groundwater system beneath this site does not represent a viable water resource. Consequently, actual human exposure under any future use scenario is unlikely to occur. All residences and businesses in Cincinnati and Norwood are served by their respective municipal systems. All future inhabitants of this site would likely also be subject to local well installation requirement or water authority permission directives. The groundwater system is perched and discontinuous across the site. The glacial material consists of tightly packed clays and silts with hydraulic conductivities on the order of 10^{-6} to 10^{-8} cm/sec. Therefore, further evaluation of groundwater is

not required.

- Several constituents were detected in soils at concentrations that could, under certain conditions, leach to and possibly adversely affect groundwater. Of these, only lead and manganese was detected in groundwater in 1997 sampling events. Further evaluation, however, is not required to address this situation as the groundwater impact is limited, conditions are expected to improve with time as a result of natural attenuation processes, and the groundwater has been identified not to be a viable water resource.

Risk estimates were calculated generally using conservative inputs and assumptions and the risk estimates were well within acceptable targets, particularly considering the most realistic exposure pathways. BASF implemented a "hot spot" removal and sampling evaluation program to address residual chemicals found in Tank Group 12, found in the vicinity of one boring on the southern portion of the property just south of the railroad area (boring CSB-51), and to address the one boring in the northern portion of the site where the anomalous metals concentrations were found in a subsurface soil boring (CSB-54). This current revision of the risk evaluation has taken into account the confirmational or replacement sampling performed in the North and South of Railroad non-SWMU and Tank Group 12 areas. At this point, although the risk estimates for potential realistic exposures at the site have been estimated to be less than the Ohio EPA's target risk of 1×10^{-5}, all risk estimates are actually less than a more conservative target of 1×10^{-6}.

5.0 SUMMARY

Extensive environmental sampling and remedial activities have been conducted at the BASF Dana Avenue facility since 1990. A risk assessment, based on data obtained during a complete site characterization in 1997 and 1998 following all remedial activities, indicates that site risks fall within acceptable ranges for all SWMU areas, and also fall in acceptable ranges for all non-SWMU areas. Groundwater is not used and highly immobile at the site, and detected organics are found in only isolated and limited areas. Based on the site conditions, no further action should be required.